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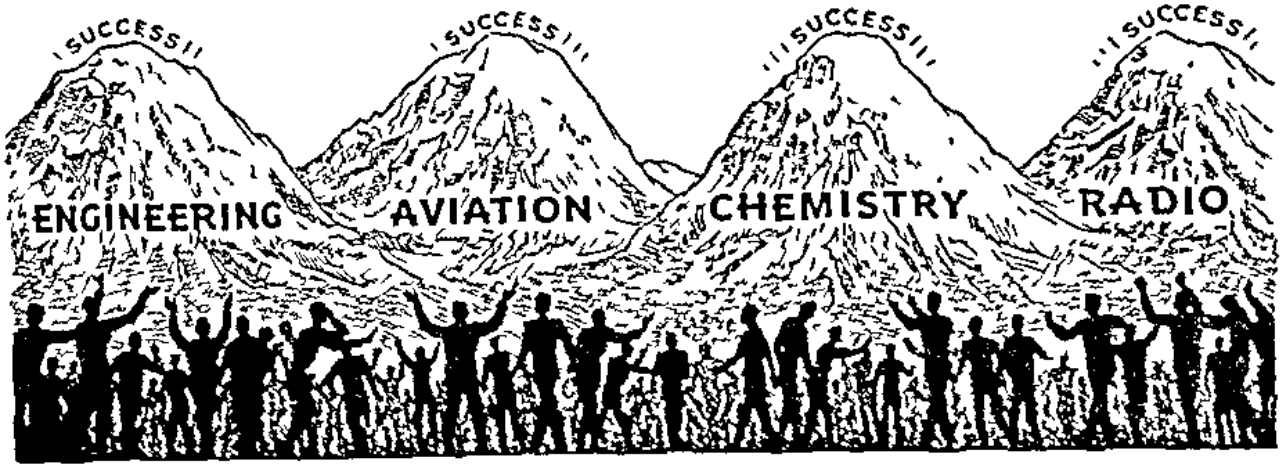
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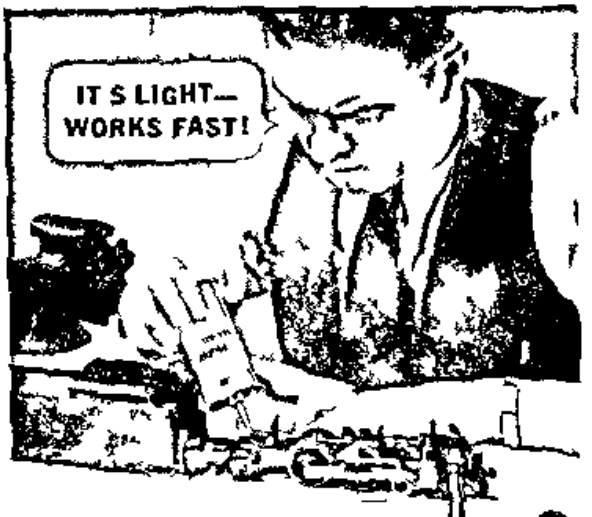
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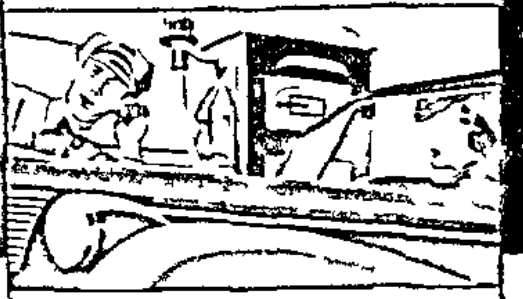
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"IMAGINE! HE SAID MY CAR HAD NO OOMPH!"

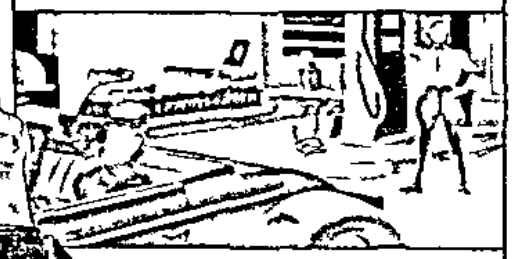
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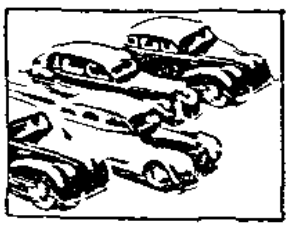
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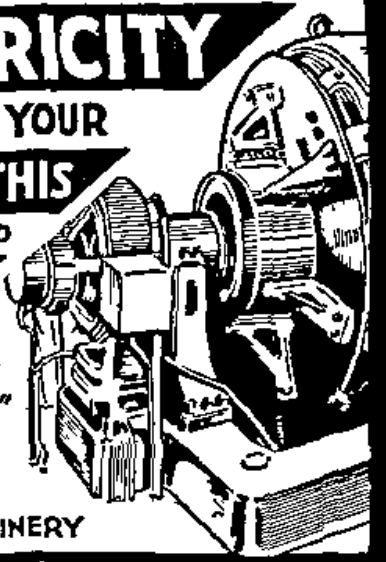
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- ☐ Effective Speaking
- ☐ Stenotypy



Name

Age

Position

Address

Our Readers Say

CONTINUED

holder that will shout out loud when I pick it up whether it is empty or loaded and un exposed or loaded and exposed What to do —T U Columbus Ohio

Winging Pop Bottles at the Ump Teaches Us Something

ON TURNING to page 87 of the August issue I was amused by the picture of a soldier from some European army testing an antitank bomb consisting of a pop bottle filled with an inflammable liquid Maybe it isn t very polite to laugh at others but I got a good laugh at the pose the soldier is striking as he throws (?) the bomb Left hand on hip he has just let fly with the bomb by a sideward flick—just that—of his right arm Any American boy between six and sixty who threw anything with that technique would be laughed off the sand lot and any baseball fan between Brooklyn and Podunk Center who couldn t wing a pop bottle w th more finesse at an umpire wouldn t even be allowed in the bleachers—E S B St Louis Mo



Insomnia Is No Problem —in the Classroom!

THERE S nothing new under the sun In your August issue you tell about a college course given at Columbia University which makes students sleep soundly That s old stuff We have professors at my college who have been doing that for twenty or thirty years—and without trying —E M J New York City

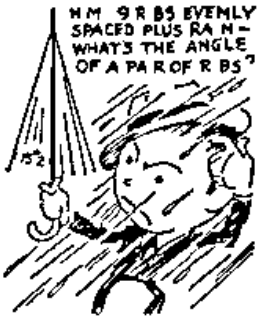


First Bullet, O K, Second Bullet, Ixnay!

JUST received July issue of PSM today and am enjoying it very much I always read it from cover to cover Particularly interesting is the Gus Wilson Model Garage story Our Readers Say and With the Inventors One thing amuses me this month in the latter It is the military helmet designed by Percy L. Crosby that is supposed to bounce bullets aside After looking it over I found myself wondering just what would happen if a second bullet came along before the crown was pulled back to the brim of the hat by the coil springs—M L Z Taneytown Md

Don't Smash Any Umbrellas Figuring This One Out

THE trouble with N S s little algebra problem proving by algebraically correct steps that 1 is equal to 2 lies in the fact that the factor (1—x) on each side of his equation x (1—x)=(1+x) (1—x) is equal to zero this because x equals 1 as given and 1—1 equals zero Now anything multiplied by zero equals zero so the other factors need not be equal They were not as it turned out and the equation boiled down to the obvious error It seems to be customary to answer one problem with another so I retaliate with one involving a bit of trigonometry A nine ribbed umbrella is stripped of its fabric covering so that its ribs are straight even when they open They are opened so that each rib makes an angle of 15° 13 with the center stick Find the angle any rib makes with one next to it and I hope it doesn t rain before you get a new umbrella—P M D Columbus Ohio



He'd Like To Read a Story on Nonfraudulent Spiritualists

SOME time ago you published an article in your magazine exposing the methods employed by fraudulent spiritualists I should like to see another article covering phenomena which have *not* been proved fraudulent and possible scientific explanations This would prove very interesting as would an article on present-day findings in the realm of mental telepathy Incidentally your new arrangement makes things of interest much easier to find in my opinion—W S P Corry Pa



That Article on Future Cars Is Still Hitting on All Cylinders

MY MORNING paper recently summarized a talk made by David Beecroft a past presi

(Continued on page 14)

Step Up Where You Belong

What Is Your Present Level of Preparation?

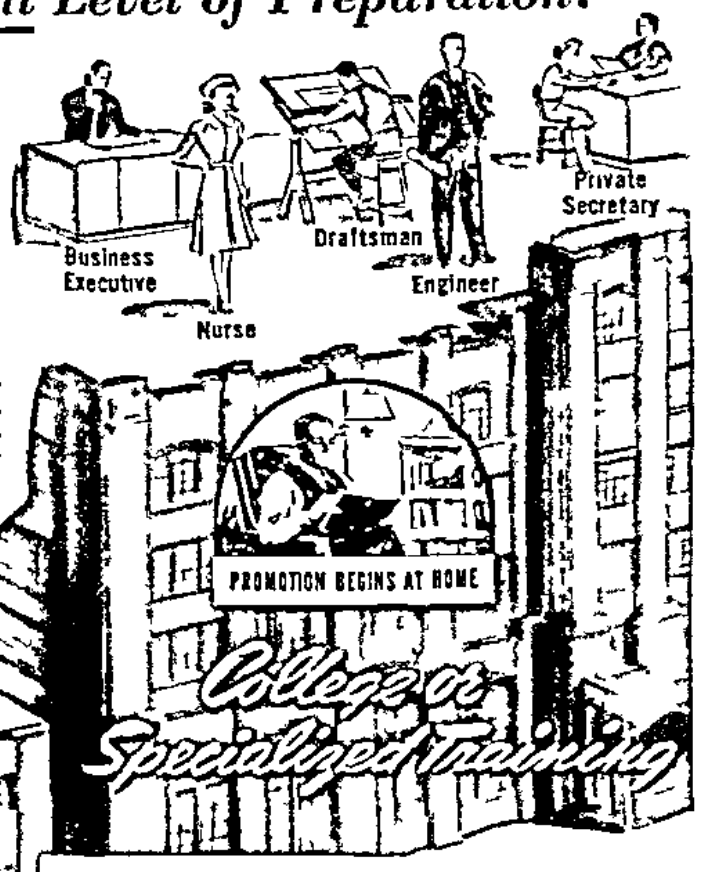
The FIRST proof of personal ability is your capacity to see the *need* for training and to GET IT. The man or woman who doesn't *realize* that education is VITAL to success—or who says he or she doesn't have time, hasn't the money, or that study is too hard—simply lacks one of the *fundamentals* of the ABILITY to make good. *American School (Chicago) graduates* by the thousands have PROVED that anyone who WANTS an essential education CAN HAVE IT. *You can too.*

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☐ Diesel Engineering	☐ Retail Merchandising

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Spare Time Training Can Help You in Your Work—and Socially

Our Readers Say (CONTINUED)

dent of the Society of Automotive Engineers at a meeting of that organization at White Sulphur Springs W Va I note that he points out that the future will bring cars of entirely different basic design from those of today as did your article in the June issue New Patents Forecast the 1942 Car They will have engines in the rear said Beecroft as did your article And he declared that they will have a superstructure integral with the chassis as did your article Both the speaker and your article pointed to evolutionary trends in car design and predicted what the future car would be like if the trends continued I would like very much to have heard Beecroft s talk as I am intensely interested in the subject At the same time I doubt if I would have enjoyed it any more than I did your article In telling what cars of the future will be like the author of your article did a splendid job basing his predictions on sound reasoning Good stuff Let s have more like it —F L New York City

The Ice Age Was a Myth, Declares This Reader

Replying to B L C Trumansburg N Y in regard to the Ice Age will say that the Ice Age is only a myth If not why do we find the skeletons of animals also the bodies of perfectly preserved mastodons and other creatures that once lived in a hot country? At one time there were continents in both the Pacific and Atlantic oceans which were sunk by an earthquake so terrific that it caused a tidal wave that swept over what is now known as Manchuria carrying everything north in its path Buried cities are found in that country to this day When the water receded it brought down the ice over both hemispheres destroying nearly everything preserving some things All this was many centuries ago some estimate it as far back as 70 000 years —W L G Oakland Calif



There's No Use Trying It, Even in Modern Warfare

Your recent article on coast-defense guns reminds me of a rather priceless comment once made by Admiral William D Leahy then Chief of Naval Operations U S N before a Congressional committee Here is the official record of the testimony Senator Gerry It is an old established naval policy is it not that you cannot attack successfully land fortifications with even capital ships if these land fortifications are modern and in proper condition? Admiral Leahy I think it would require a very dire necessity to induce any naval commander to take his fleet under the fire of modern shore batteries Senator Gerry Because the advantage is entirely with the shore battery is it not? Admiral Leahy The shore battery has one very decided advantage It does not sink when it gets hit with a shell I think that rates the Admiral as something of a wit— B T Newark N J

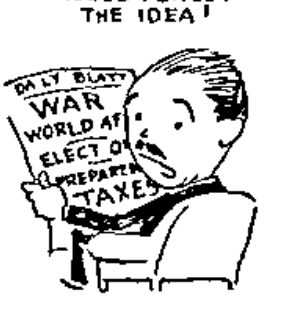
Father Burned His Fingers When He Bought That One!

The curious self-destructive pepper shaker that A D N of Vancouver B C writes about reminds me of what happened once when I was a small boy before electric lights In those days a good lamp chimney was an important matter Father bought one that was supposed to be shock and heat proof To show it could take it the dealer threw it over his head and it fell to the floor without breaking We used it for several weeks when one night as usual Father blew out the light and went to bed After the chimney had time to get thoroughly cooled we all heard a loud explosion similar to a pistol shot We found the lamp chimney blown into hundreds of tiny pieces and scattered all over the room Maybe some reliable glass factory can explain it At the time we found no one who could—A H E Los Angeles Calif



And the People of Florida Might Like To Keep Their Gulf Stream

H I C s idea about pumping Gulf Stream water to the antarctic is a pretty impractical one I think In the first place it would be virtually impossible to lay a pipe line that far not to mention the cost of keeping the pipe in condition In the second place the cost of pumping would be terrific And in the third place why not pump the Gulf Stream water to New England where we wouldn t have to travel several thousand miles to take advantage of it If he s so stuck on pumping it?—J G G, Gainesville Fla



The ships that NEVER came in!



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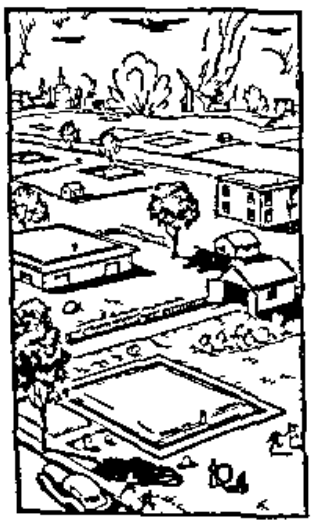
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With the Inventors

WHAT are the greatest American inventions? A committee of seventy five scientists and industrial leaders recently examined eighty outstanding American inventions and selected nineteen for the roll of honor Try making your own list before you read the roster that follows Eli Whitney s cotton gin Robert Fulton s steamboat Cyrus Hall McCormick s reaper Samuel F B Morse s telegraph Charles Goodyear s rubber vulcanization process Elias Howe s sewing machine Christopher L Sholes s typewriter George Westinghouse s air brake Alexander Graham Bell s telephone Thomas A Edison s phonograph incandescent lamp and motion picture projector Nikola Tesla s induction motor Charles M Hall s aluminum process Ottmar Mergenthaler s linotype machine Wilbur and Orville Wright s airplane Lee De Forest s three electrode vacuum tube Leo Baekeland s synthetic plastics and William M Burton s oil cracking process And suppose you had to select the three greatest inventions from this list of nineteen—send a note and let us know which trio you would choose

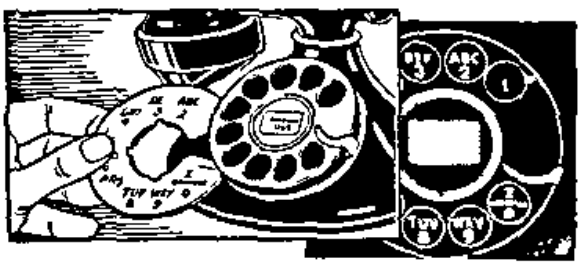




FOR PROTECTION AGAINST the ravages of dust storms hurricanes tornadoes and bombs dropped from the skies Andre D Amico of Rochester N Y suggests homes that can be made to disappear into the ground Built over a pit dug in the earth the two story structures are lowered into the hole by means of a hydraulically operated plunger so that their reenforced metal roofs are flush with the ground level Movable bolts attached to the houses rest on a ground level ledge to support the structures when in their normal raised positions HARDLY A SINGLE WEEK passes without the issuance of at least one patent for some new kind of a coat or garment hanger



IF A DRIVING rainstorm comes up during the night you ll find your windows will close automatically if they are equipped with a device worked out by Peter Pusak of Eddystone Pa Wires attached to the window sash are fastened to a spring operated roller mounted on the sill When the window is open a strip of special paper holds the roller against the action of its spring but when rain or fire causes the paper strip to break the roller is free to draw the open window down to a closed position WHAT ARE BELIEVED to have been the first patents ever issued in the world were granted by the ancient Greeks to their chefs to encourage the invention of new palate tickling food concoctions Wonder who got the first patent on hash WITHOUT CHANGING or removing any telephone parts an attachment developed by George I Dormont of



Los Angeles Calif provides luminous numerals to make it easy to dial numbers in the dark or in phones located in badly lighted corners or booths Made of metal plastic or heavy paper in a dark color the attachment consists of a flat ring that fits in

(Continued on page 18)

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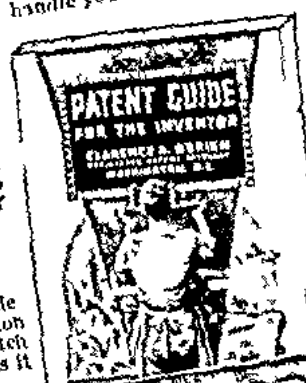
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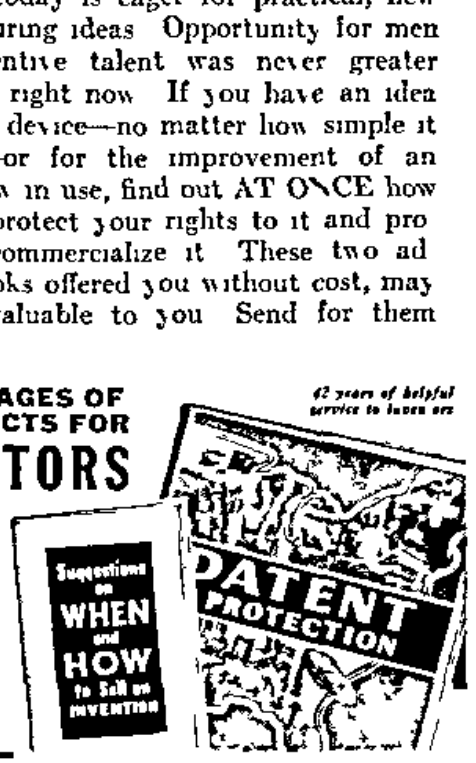


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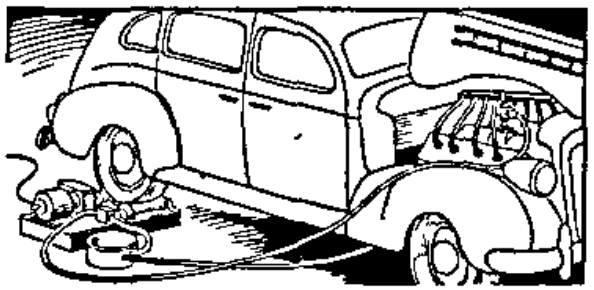
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With the Inventors

(Continued from page 16)

place over the standard ring bearing letters and numerals The accessory duplicates the marking of the original but with some such luminous material as phosphorescent paint or a radium salt composition . . . THE REGISTRATION OF commercial prints and labels has been transferred from the juris-



diction of the Commissioner of Patents to that of the Register of Copyrights in the Library of Congress . . AN EASIER METHOD OF REMOVING carbon from an automobile engine than the common practice of removing the cylinder head and scraping or burning carbon from the affected parts, is outlined in the specifications for an apparatus credited to George Hofele, of St Louis Mo Rollers turned by an electric motor drive the rear wheel of a car, and since the engine is left in gear, the pistons are set in motion A pump forces a special liquid through a tube into a manifold which distributes the carbon dissolving fluid to all cylinders through spark plug and carburetor openings The exhaust manifold of the engine is blocked to prevent the liquid from being discharged during the cleaning process . . DRAWINGS IN PUBLISHED PATENTS for new plants appear in full color . . NO SCREWS NAILS or other type of permanent attachment is needed to hold in place novel brackets designed by James H York of Cincinnati Ohio to support both a window shade and curtains Made of metal the brackets are provided with separate notched



(Continued on page 20)

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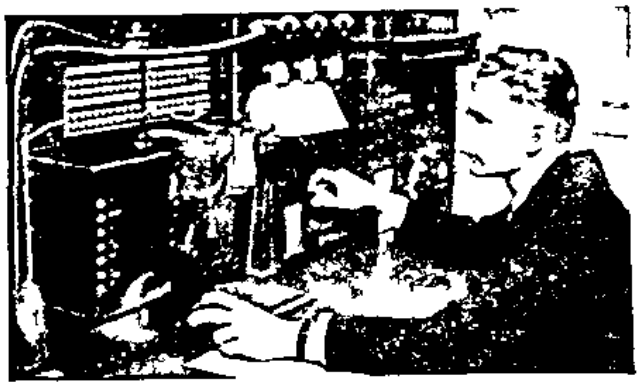
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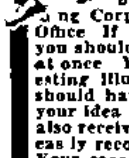
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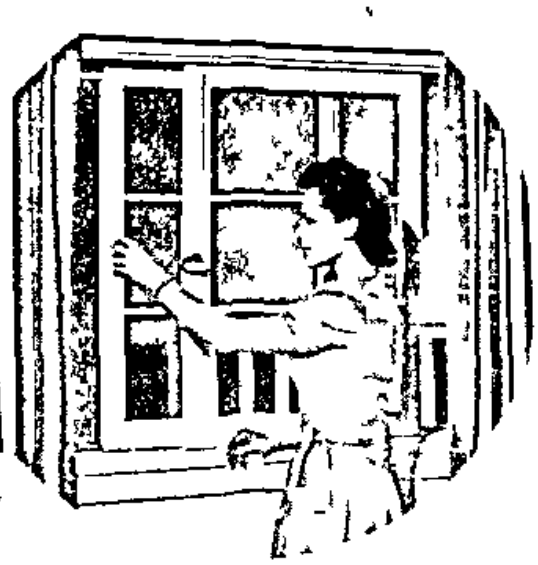
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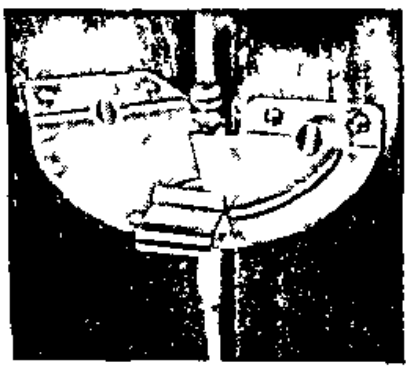


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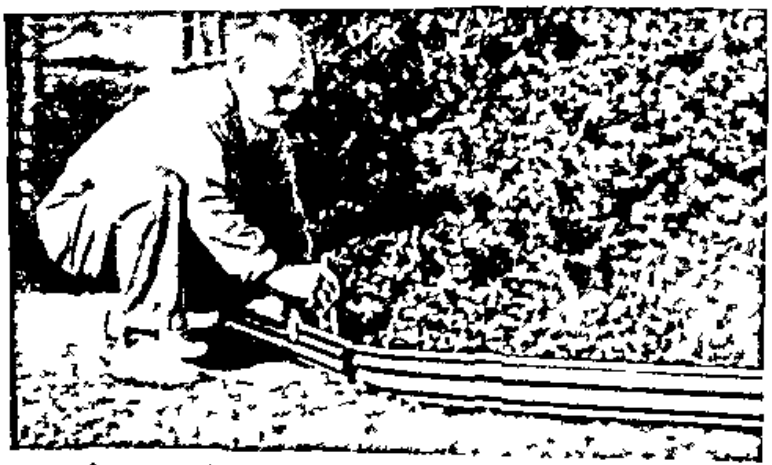


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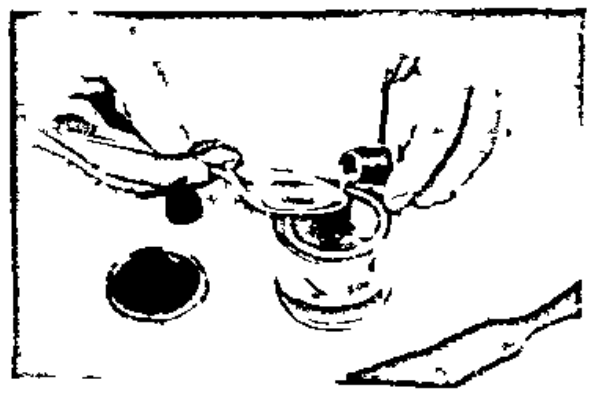
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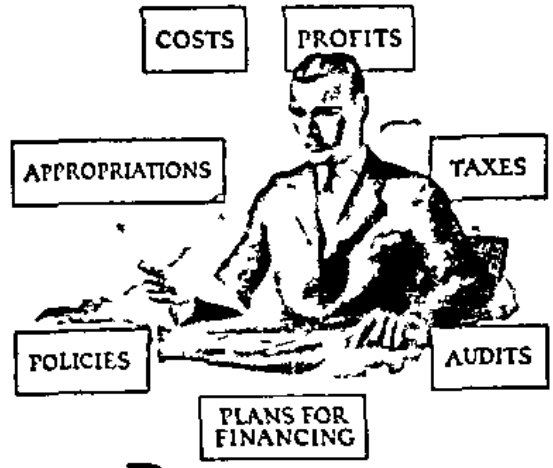
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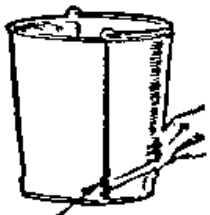
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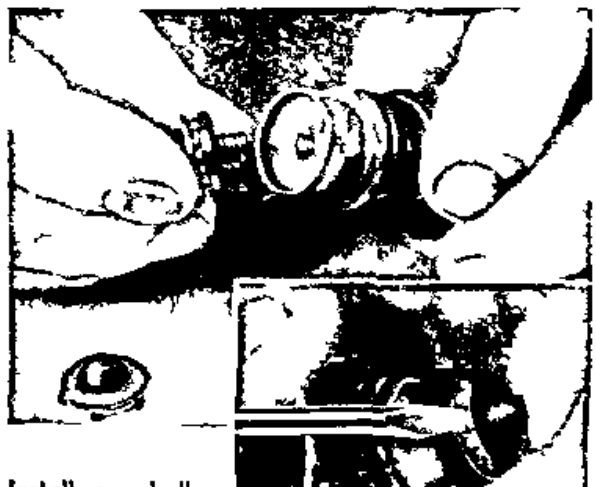
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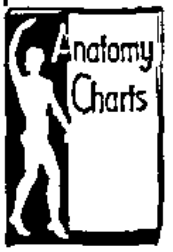
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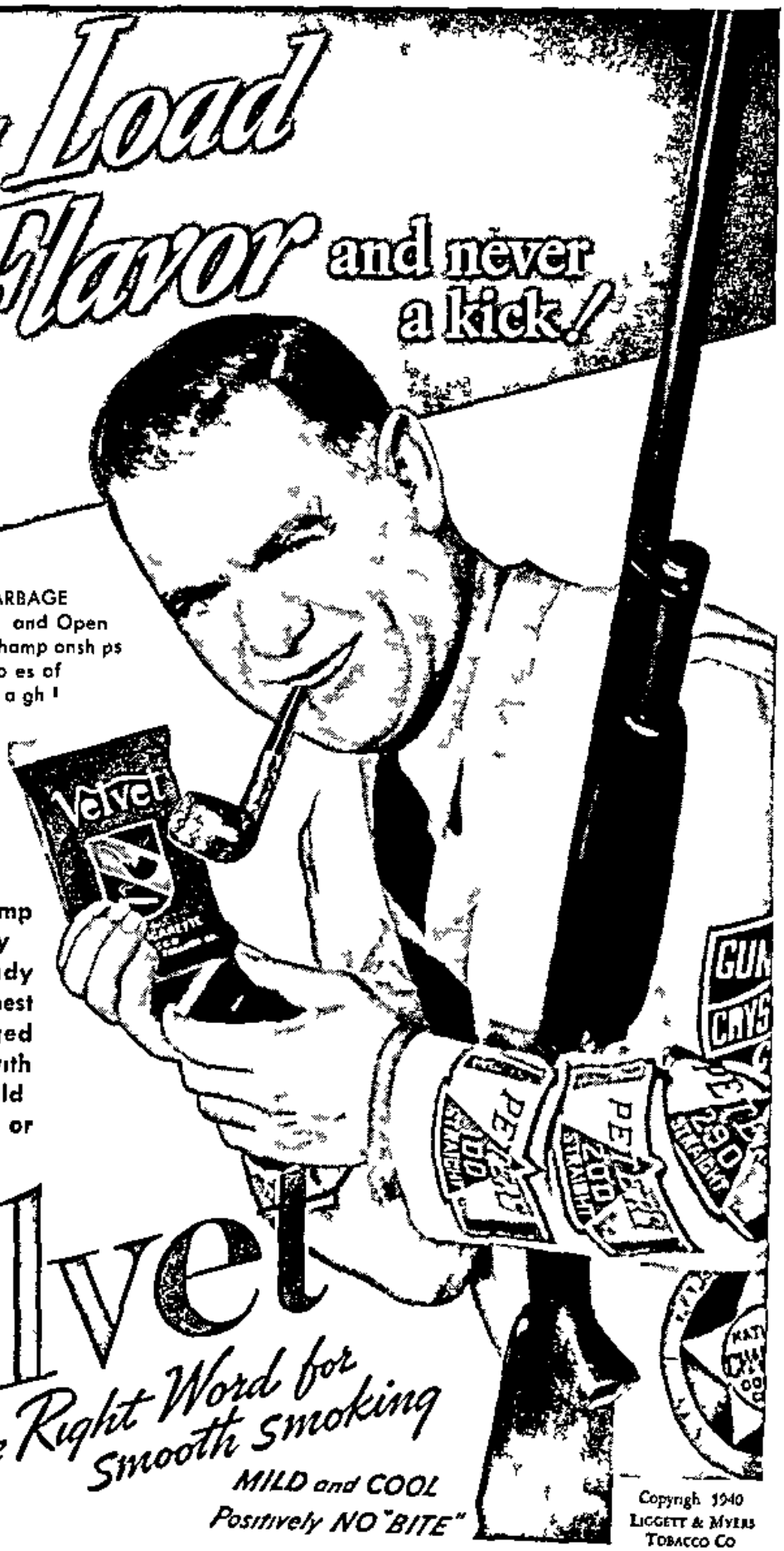
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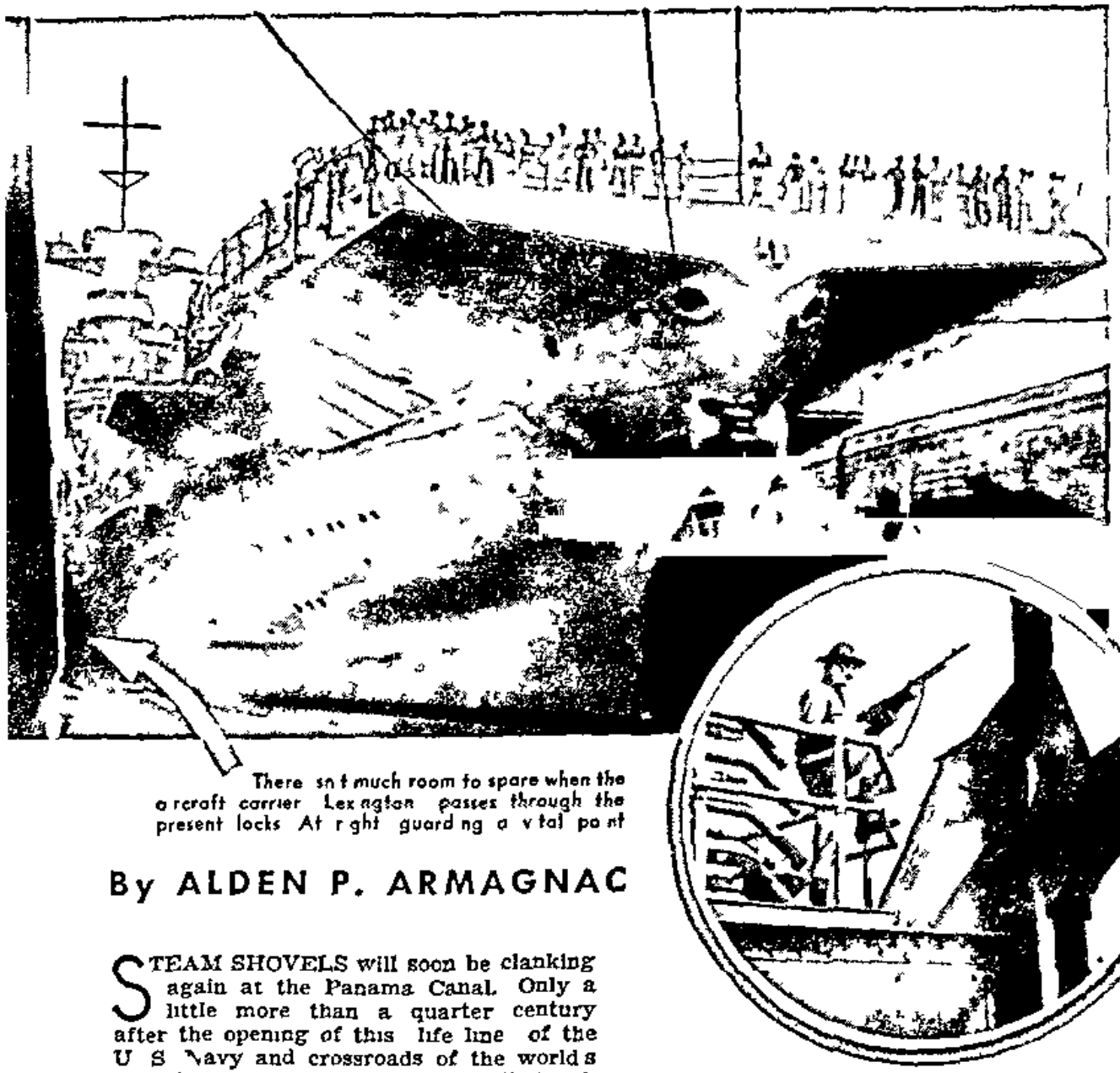
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RAYMOND J BROWN, Editor

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Enlarging the Panama



There isn't much room to spare when the aircraft carrier Lexington passes through the present locks At right guarding a vital point

By ALDEN P. ARMAGNAC

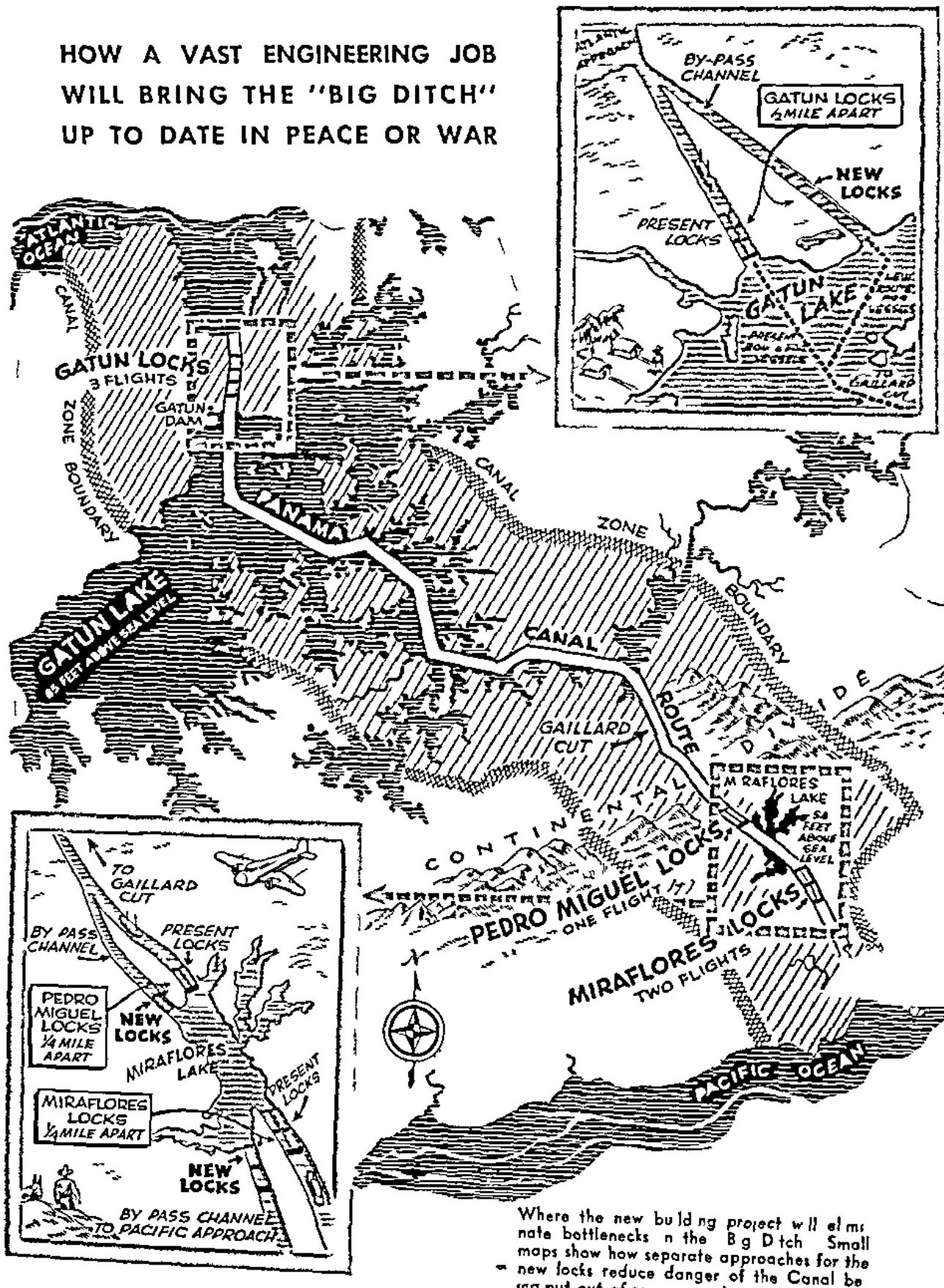
STEAM SHOVELS will soon be clanking again at the Panama Canal. Only a little more than a quarter century after the opening of this life line of the U S Navy and crossroads of the world's maritime commerce workers will break ground for a monster third set of locks—a project whose $277 000 000 cost equals more than half that of the present canal!

The giant engineering scheme calls for conversion of the present two-lane canal across the Isthmus into a three lane canal. To do this three sets of oversize single chamber locks will be built parallel to the present twin chamber locks but at some distance from them There will be no need to dig a whole new canal since the Big Ditch itself will easily carry the traffic.

Why the new locks? First and foremost they will assure the U S Fleet of unobstructed passage between the oceans in cases of emergency Canal authorities long have been jittery over the possibility of sabotage or direct attack on the present locks A vessel might be blown up or time bombs might be dropped in a lock chamber or the locks might be bombed by raiding planes If a heavy explosion or a lucky hit from the air happened to destroy two side-by side lock chambers at once the entire Canal would be put out of commission. Therefore for many months a force of sev

Canal FOR BIGGER BATTLESHIPS

HOW A VAST ENGINEERING JOB WILL BRING THE "BIG DITCH" UP TO DATE IN PEACE OR WAR

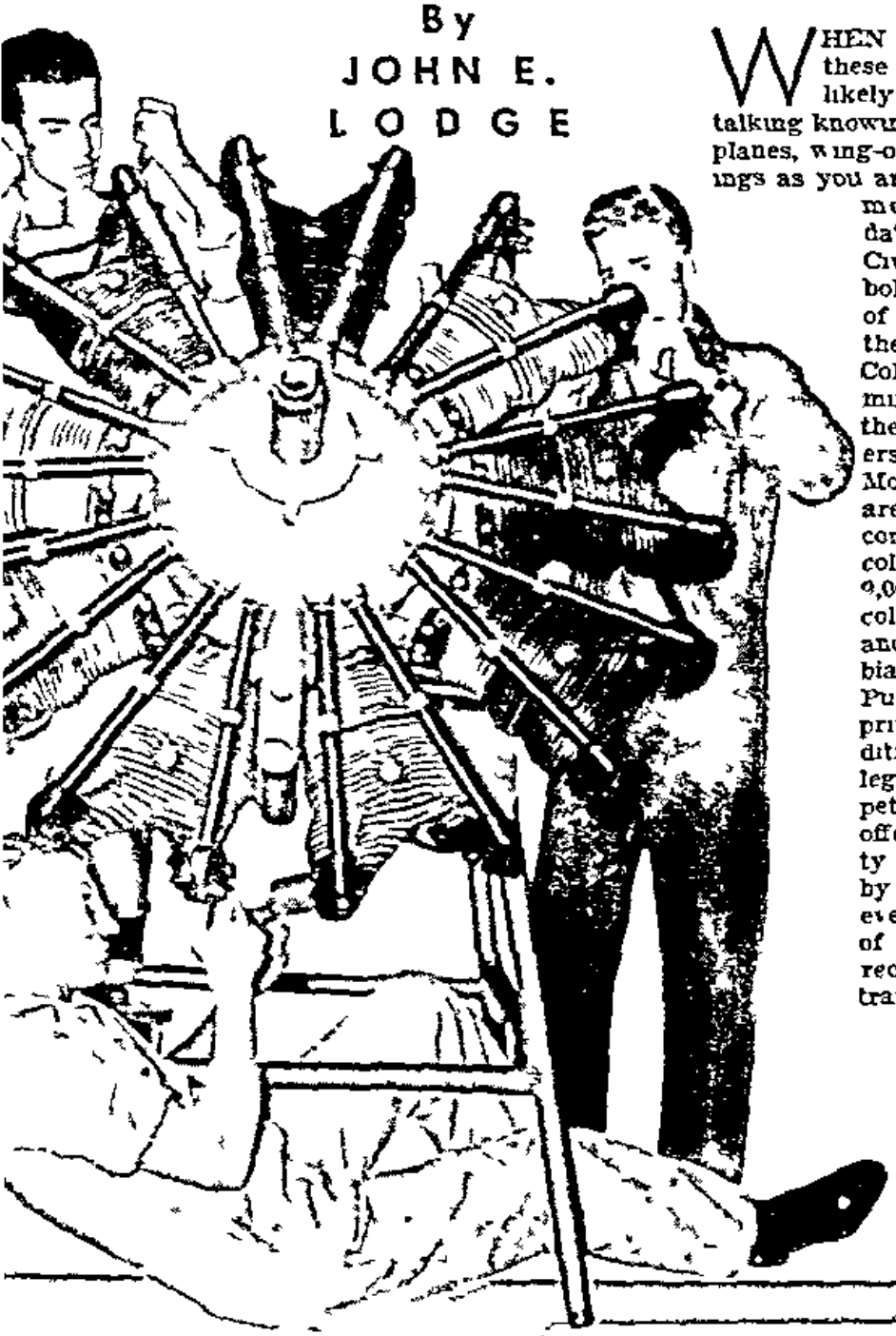


Where the new building project will eliminate bottlenecks in the Big Ditch. Small maps show how separate approaches for the new locks reduce danger of the Canal being put out of commission by enem[illegible]

FLYERS BY THE TEN

Training Program in Colleges To Provide Huge Army of Pilots for Uncle Sam

By JOHN E. LODGE



WHEN you walk across a campus these days you are quite as likely to hear undergraduates talking knowingly about low wing monoplanes, wing-overs, and cross wind landings as you are to hear them discussing mouse-trap plays, heavy dates, or passing marks. The Civil Aeronautics Authority's bold and successful venture of training youthful flyers by the thousands has made John College and Jane Coed go air-minded Don t think that these collegiate aviation talkers are mere "hangar pilots" Most of them are flyers, or are well on the way to becoming flyers During the college year of 1939-40 about 9,000 of them, enrolled in 437 colleges located in every state and in the District of Columbia, Alaska, Hawaii, and Puerto Rico, earned their private pilot licenses In addition, well over 700 noncollegians, winners of competitive flight scholarships offered the students in seventy ground courses sponsored by civic organizations in every state and in the District of Columbia and Alaska are receiving exactly the same training

College students learning about airplane engines as part of the ground school training in the Civil Aeronautics Authority program



THOUSAND



Girls are eligible too and many of them already have qualified for their private pilots' licenses

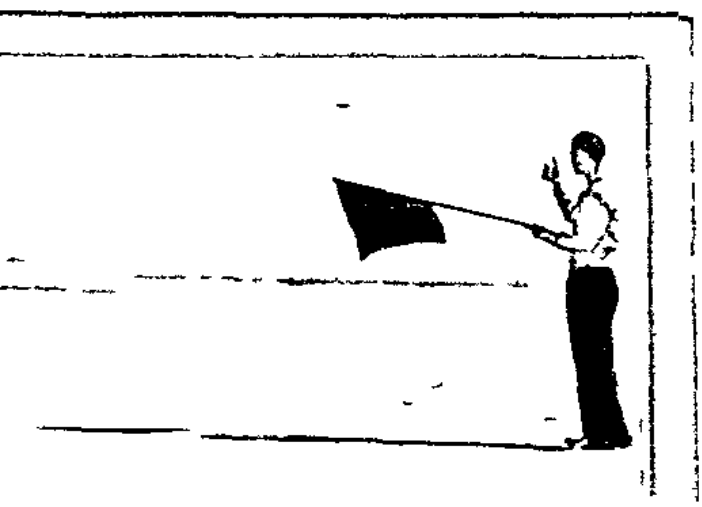
When this nation-wide training effort was started last fall, its primary objective was to accelerate the already swift progress of civil aviation in the United States by teaching large numbers of young men and women to handle their own airplanes safely in either pleasure or utility flying A secondary objective was the building up of a reserve of physically sound, partially trained pilots for possible service in the Army or Navy in the event of war

The swift and menacing march of world events in the past few months has brought about a reversal in the degree of importance placed on these objectives Now most of the emphasis is on the national-defense aspect of the program, which has been greatly expanded. In the course of the coming year the C.A.A. courses will give ground and primary flying training of 45 000 students in three intensive courses, each of which, instead of being spread over the school year, will be compressed into four months In addition, the 9 000 1940 graduates—over ninety percent of them have indicated their desire to become military flyers—will be given forty five hour advanced courses in faster planes than those which are used for the primary training

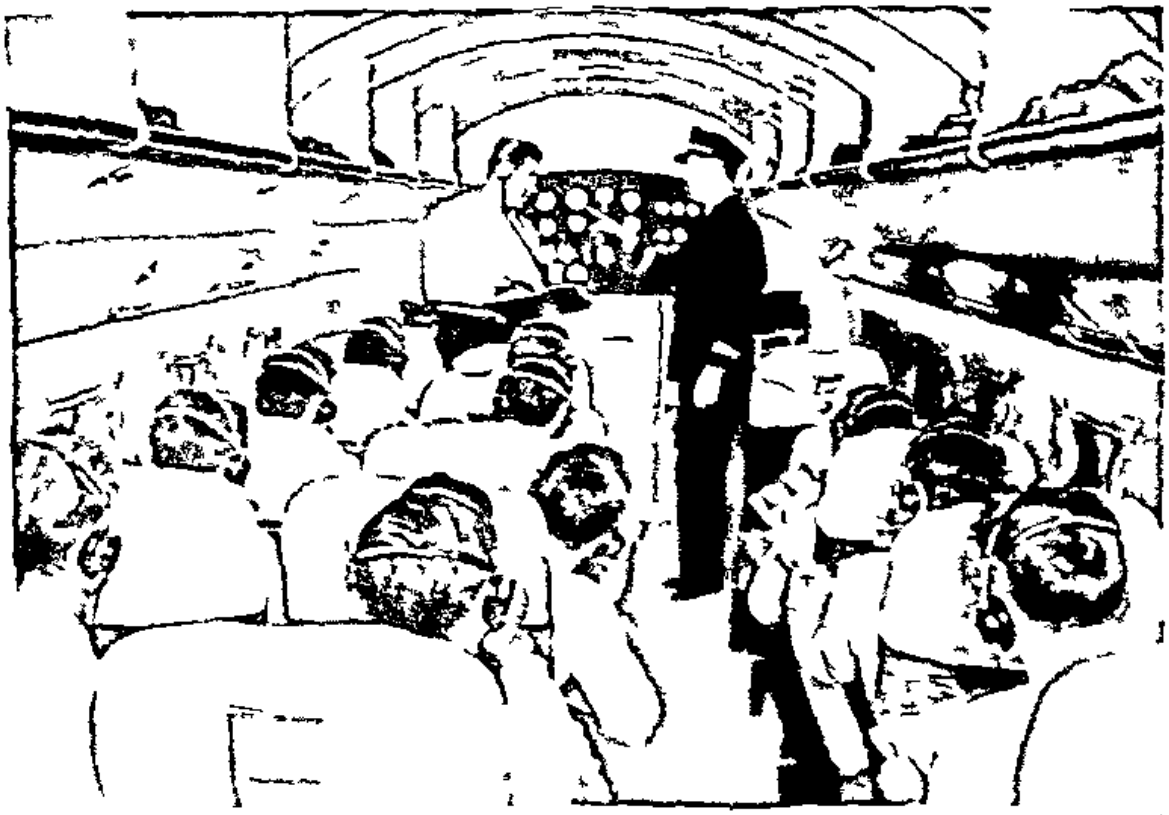
The Civil Aeronautics Authority, the Government agency charged with the regulation of civilian aviation has no direct connection with the armed services The graduates of its flying courses are not combat flyers, and have no military obligations which are not shared by nonflyers of the same age But the training they receive is the equivalent of the flying training given Army and Navy flying candidates, and it will enable many of them to qualify as combat flyers after six months of advanced specialized training in service flying schools

When the project of providing wholesale flight instruction first was considered late in 1938, an abnormally high percentage of student flyer accidents was helping to make private flying, with a safety rate of only 750,000 miles for each fatality, the most hazardous form of aviation But careful investigation indicated a method by which mass production of pilots might be achieved with a high degree of safety It was found that the students of flying schools which had thorough ground courses and sound flight courses suffered far fewer fatalities than did the graduates of schools whose instruction standards were lower

Placing heavy emphasis on safety, C.A.A. experts worked out a ground course which would teach students why and how airplanes fly and a flight course which would enable instructors to nip bad flying habits in the bud In the spring of 1939, with $100,000 of National Youth Administration funds, a test program was started in thirteen selected colleges Undergraduates enthusiastically grabbed at the chance to learn to fly—so enthusi-



A campus flyer comes in for a landing The flight training is given by plane operators at near by airports

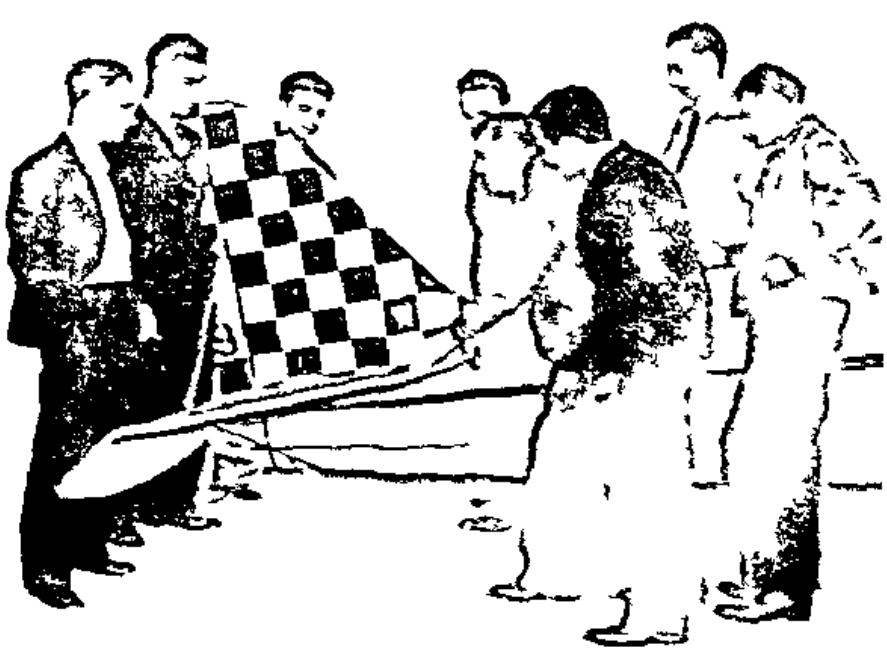


In a flying classroom, students from the University of Miami, Fla., listen in with earphones to the radio-beacon signals and watch the instrument panel while soaring 7 000 feet above the earth

astically that at the University of Alabama there were 1 200 applicants for the thirty places in the class. A total of 330 students with high physical qualifications were accepted at the thirteen participating colleges. All of them reached the solo stage and 317 won private-pilot licenses. Their average flying time to the certificated stage was thirty-eight hours and they flew a total of 1 200 000 miles with only a single fatality.

Convinced by this experience that the way to increase the safety of flight instruction was to raise the quality of the instruction the C A A. standardized its ground and flying courses and required all airmen holding flight instructor ratings to familiarize themselves with the improved instruction methods and to pass an examination to prove that they had done so. More than 4 000 instructors passed the test, assuring the Authority of plenty of highly-qualified teachers for its training program.

Congress passed a Civilian Pilot Training Act and provided $4 000 000 for the 1939–40 courses. Undergraduate interest was so keen that colleges ranging from stately ivy-



An instructor explains the working of the tail surface of a plane. The thorough ground training has produced a remarkable record for safety

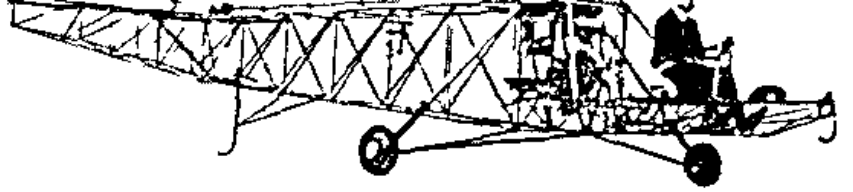
covered institutions to little city and junior colleges offered the pilot training courses

When school opened last September over 9 300 undergraduates who had passed the searching physical examinations given by C A A flight surgeons were accepted as students By June they had logged 310 000 dual and solo flying hours—almost 22 000 000 miles—with very few mishaps and only one fatality That remarkable record is an improvement of 3 700 percent over the safety record for flight training for the whole country only a year ago

Under the terms of the Civilian Pilot Training Act at least five percent of those enrolled for the courses must be noncollege students To provide instruction for these the C A A enlisted the coöperation of chambers of commerce university extension services American Legion posts aeronautical associations and civic clubs in communities of every state The ground courses which are exactly the same as those offered in the colleges are open to anyone but to be eligible for one of the ten flight scholarships offered with each course the student must pass the same physical examination given the col *(Continued on page 219)*

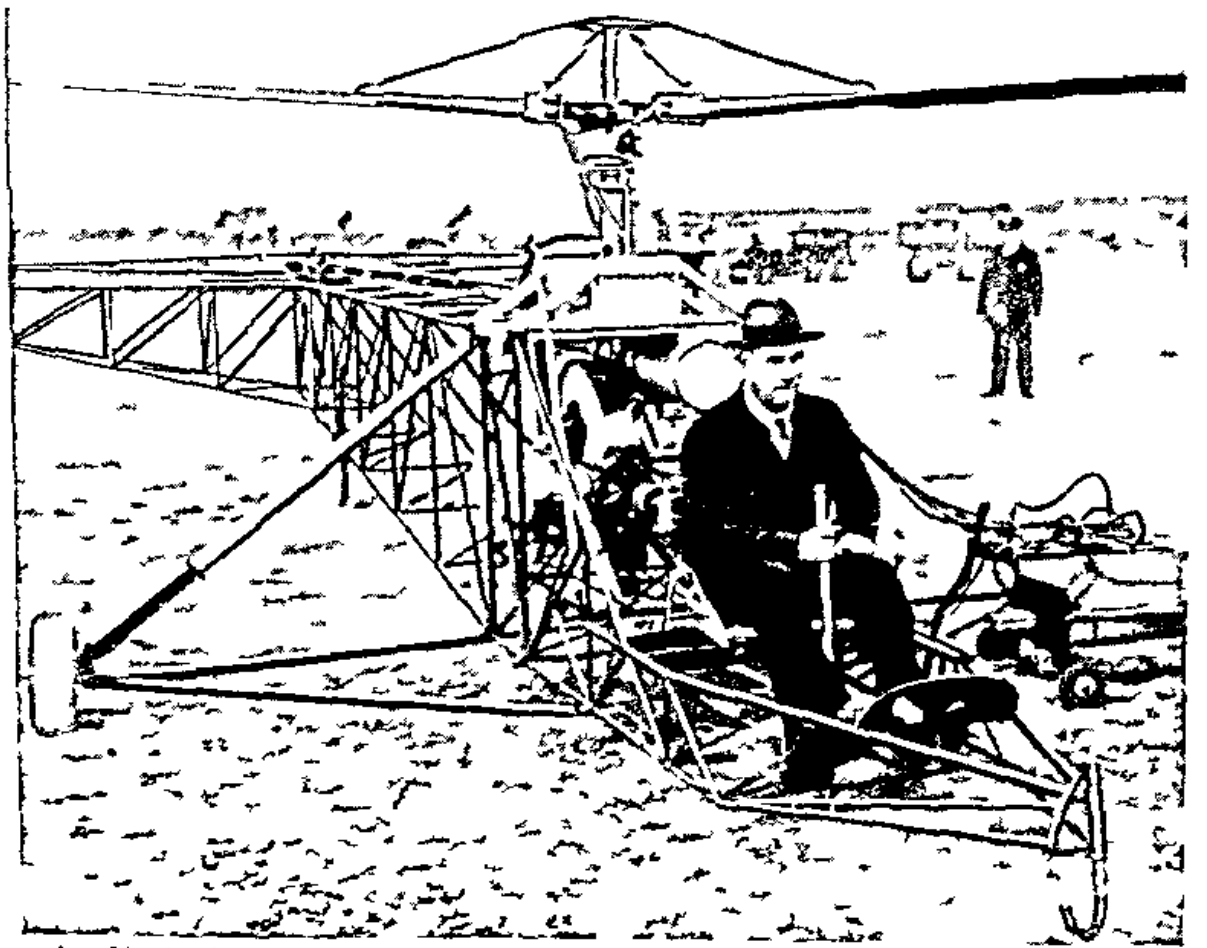


Some schools have shops like the one below where students learn to build and service aircraft by actual practice At the right a flying coed uses an instrument to gauge height of the ceiling



Helicopter Flown Successfully

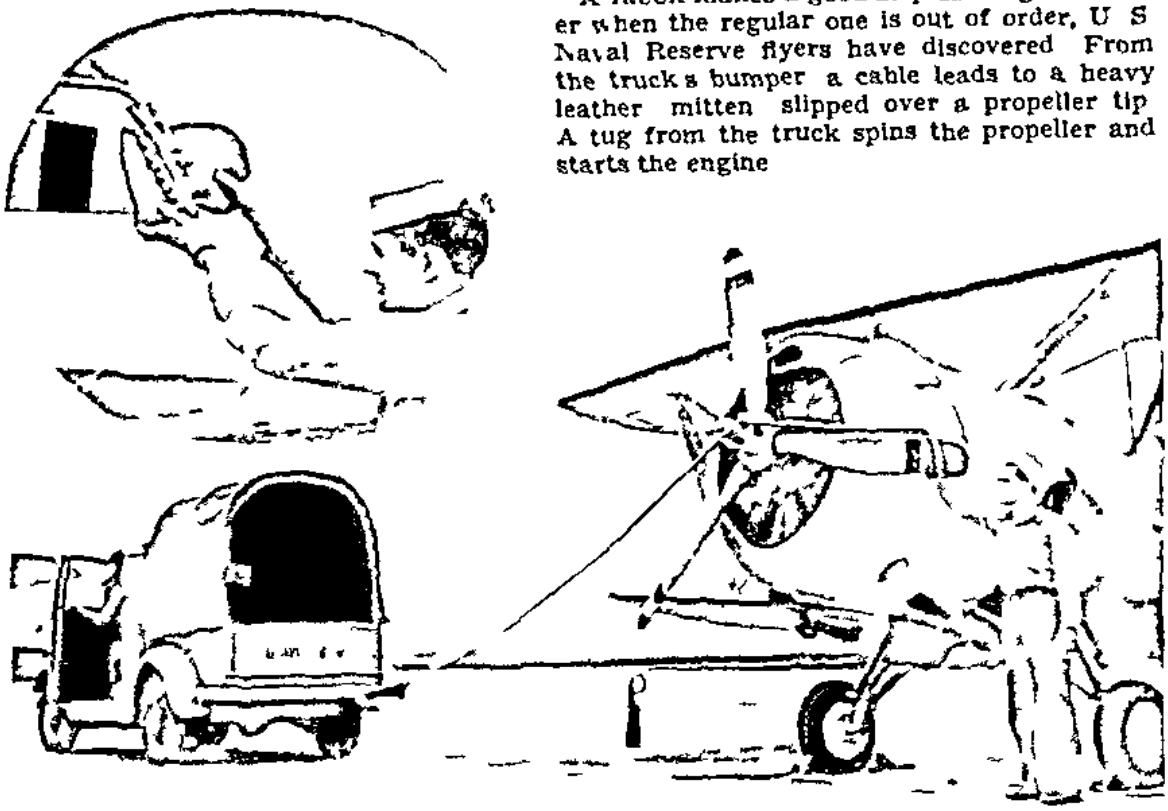
WHAT is claimed to be the first successfully controlled vertical flight in a heavier than air machine was made recently by Ivor Sikorsky prominent aeronautical engineer at Bridgeport Conn in his new helicopter Powered by a seventy horse power engine and equipped with variable pitch rotor blades the craft moved straight up from the ground for thirty feet circled the field and then settled vertically to the ground Small rotor blades mounted on the bare fuselage of the craft act as elevators and rudder Sikorsky is shown at the controls of the helicopter in the photographs



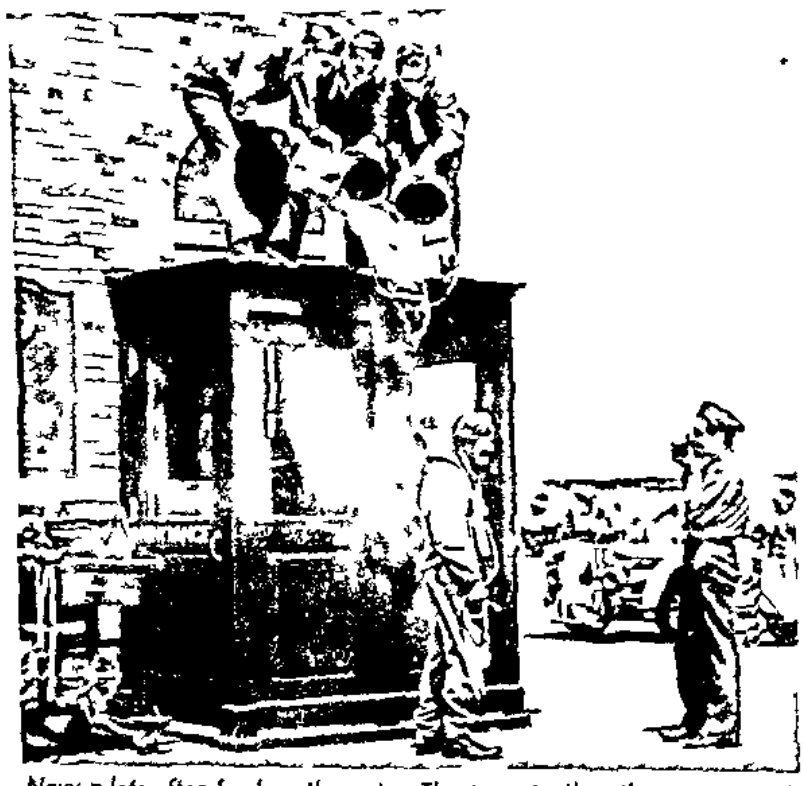
Ivor Sikorsky about to take off on a test flight in his helicopter At top the odd machine in the air

Truck Serves as Plane-Engine Starter

A TRUCK makes a good airplane engine starter when the regular one is out of order, U S Naval Reserve flyers have discovered From the truck's bumper a cable leads to a heavy leather mitten slipped over a propeller tip A tug from the truck spins the propeller and starts the engine



All set to spin the motor on a Naval Reserve plane Inset shows mitten being placed on propeller tip



Navy pilots often land on the water This time it's the other way around

Baptism Marks Graduation of Naval Flyers

HE'S learned to fly for the Navy—and now three bucketfuls of water symbolizing the Navy's domain initiate this proud fledgling into the ranks of his fellow airmen at Floyd Bennett Field New York City Scarcely less than an official decoration he will treasure the picture of the traditional ducking that a friend is about to snap Sometimes instead of getting a shower a new pilot may receive the rare honor of being tossed off the pier The Navy birdmen say there is little to choose between the soakings

Cowboys on Wheels

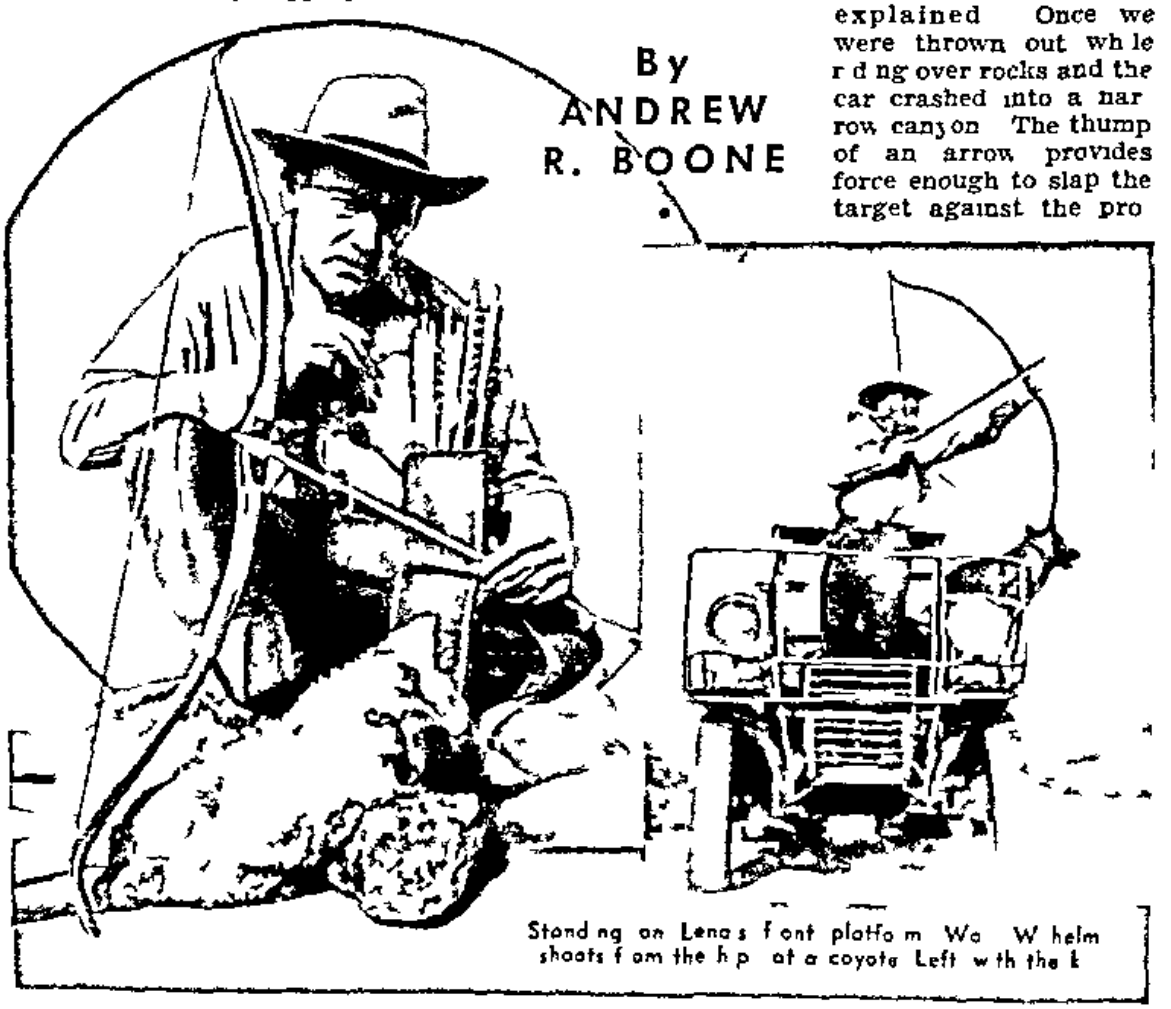
BOW-AND-ARROW HUNTERS RIDE DESERT JALLOPIES

By ANDREW R. BOONE

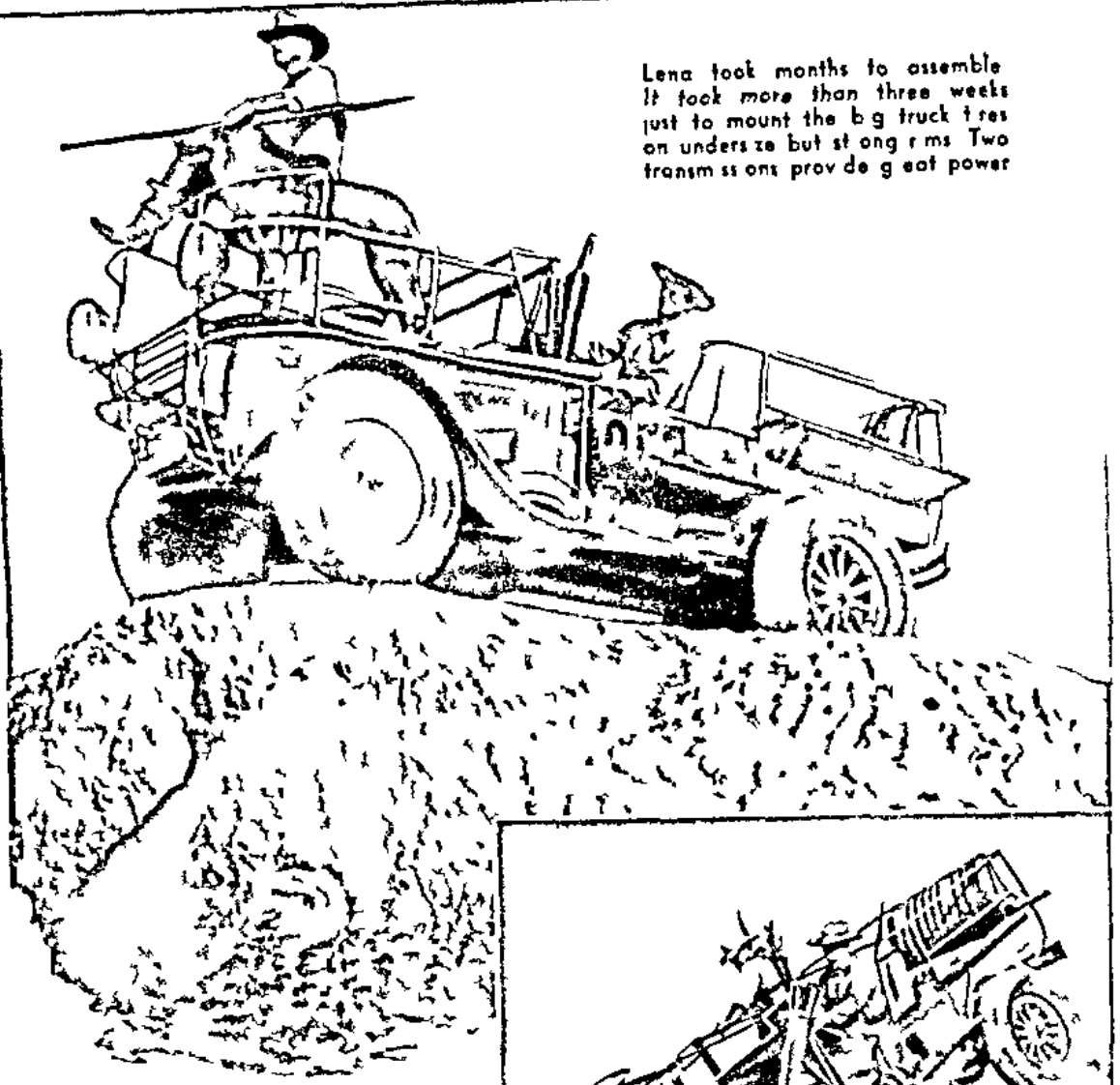
BOUNCING over bowlders zooming up steep embankments plunging down gullies two mechanical mountain goats created from automobile odds and ends carry Walt and Ken Wilhelm of Yermo Calif on daring exped tions in to the Mohave Desert Aboard these re markable vehicles called Lena and Prowler the two brothers chase jack rabbits rope coyotes hunt game with bows and arro vs explore remote corners of the desert search for fossils tra l outlaws and rescue lost travelers

They think nothing of starting Lena or Prowler across the desert leaping out and riding l ckety spl t over cactus and across the frequent washes on sle ghs or toboggans attached behind By slipping a U bolt over a spoke of the steering wheel either car can be directed in a straight line or a wide circle Sand banks and bowlders offer no obstacles to the huge tires Near Yermo I once watched Prowler roaring driverless around a circle nearly two miles wide The car plunged down narrow gull es slithered through sand overrode needle pointed cac tus spines returning in ten minutes to our side

When the car approached both men fitted blunt arrows to their bows and as it passed Walt fired quickly at a large rice straw tar get slung behind the back seat As the broad head struck the bullseye the automo b le motor stopped dead and the car coasted to a halt We never go out unless the dis connect switch is in working order Walt explained Once we were thrown out wh le r d ng over rocks and the car crashed into a nar row canyon The thump of an arrow provides force enough to slap the target against the pro



Stand ng on Lena s f ont platfo m Wa W helm shoots f om the h p at a coyote Left w th the k



Lena took months to assemble It took more than three weeks just to mount the big truck tires on undersize but strong rims Two transmissions provide gear power

jecting switch installed underneath it

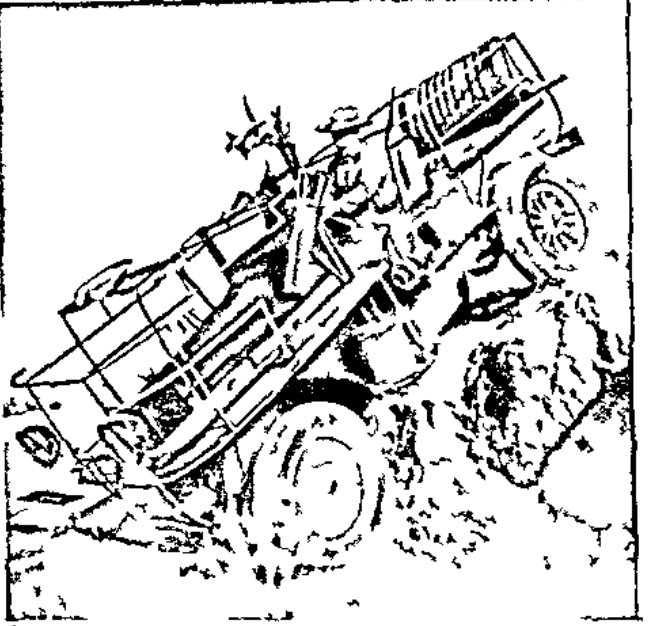
Only once has this bow and arrow shut off failed them During an early hunt for fossils at the edge of Death Valley they mounted the toboggans and took off for a slow survey of greasewood on a flat mesa Noting the car approaching near by badlands Ken prepared to loose an arrow but his bow broke

What happened to the car? I inquired

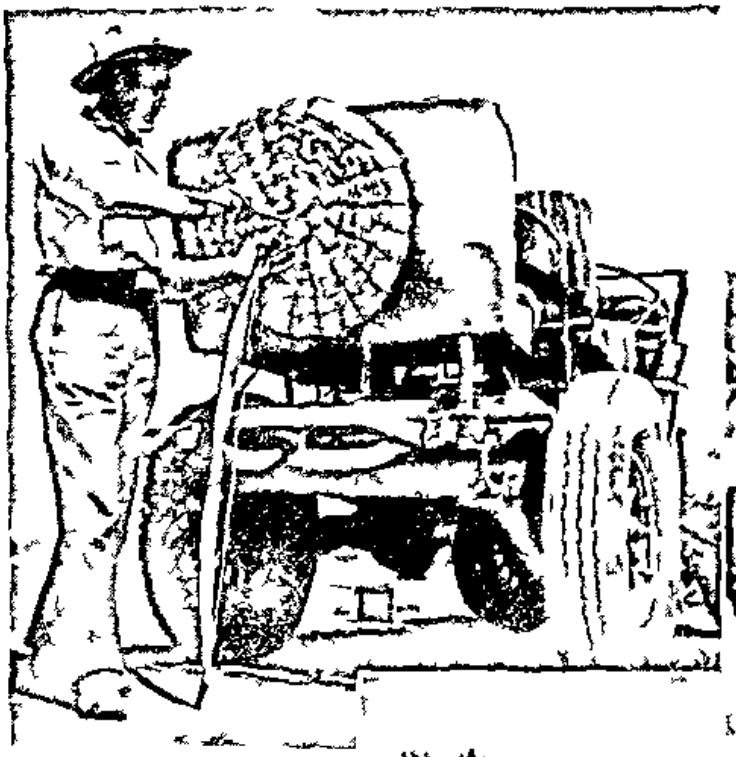
She's still there—a mess of junk

That was loss number one A few months later while playing around the treacherous potholes of Soda Sink Walt felt the tires sinking Leaping to the soft earth Ken and he rolled half a city block to hard ground When they returned thirty minutes later with timbers the car had disappeared in quicksand

Both Ken and Walt will tell you they assembled their unique desert cars for the thrill of bumping along off the beaten path That is the truth but not the whole truth Both brothers are enthusiastic archers In the desert they are able to practice incessantly now shooting at a bounding jack rabbit again loosing arrows at an artificial deer



Walt springs to a safer seat and the sturdy contraption plows straight off the edge of the hill



AUTOMATIC CUT OFF

DESERT STYLE

In case the boys are thrown by a bump an arrow shot against the target stops the vehicle With the wheel clamped (below) it travels in any fixed circle The siren is a coyote decoy





which Walt built not long ago Driven by a gasoline motor and eccentric gear it jumps up and down in the brush exactly like its prototype So expert has their desert practice made them that last summer Ken set a new world's record for distance shooting He is the first man in all history officially to send an arrow farther than half a mile

For nearly twenty years the Wilhelms have been exploring the Mohave in various kinds of vehicles Gradually they evolved their present cars You could buy the parts for either Lena or Prowler at a junk yard for $200 or so But you'd work six months putting them together It took the brothers exactly twenty four days merely to fasten the tires to the rims They started with huge twelve ply truck tires Boots countersunk and held firmly over blow-out holes by carriage bolts went in ahead of the tubes Using hydraulic jacks they struggled until they pushed the thick beads onto the narrow rims of twenty inch wheels So tightly are the beads wedged that flats never bother them The tire walls are very strong Walt explained "They'll carry us anywhere and by forcing the tires on narrow rims we anchored them so they can't turn and tear the valves out

In each of the machines they installed two gear boxes giving them many speeds forward and in reverse too Carrying only eight pounds of air in the tires they can push up a steep rocky hill with the engine turning fifty revolutions to one of the rear wheels or they can speed along the smooth high way at a two to one ratio The big tires take up most of the shock in rough going

You oughta see Ken when he's in a hurry Walt told me He'll jump straight off an embankment going fast enough to land on his wheels

Sometimes but not always Once Ken tried this stunt while chasing a coyote and straddled a hillock breaking the motor block in half After walking eleven miles for help he decided to armor plate the motor Now both Lena and Prowler are protected by a heavy sheet of boiler plate bolted against a cushion of wood beneath the pan of each engine

Another time the Wilhelms were grinding cross country in Nevada fifty miles

from the nearest crossroads when the welds holding a disk wheel to the flanges broke under the pounding vibration. Should they try to repair the damage or walk three days for help? Walt took down their .30/06 rifle and shot three holes through the disk to form an approximate triangle. Next he shot three holes in the flanges outlining a similar triangle. Finally they bolted the wheel back into place and drove slowly to a distant mine. Here using salt and fine sand as a flux, they brazed the metals tightly with the metal from used rifle shells.

On several occasions the adventurous pair and their desert cars have been pressed into service by the local sheriff for hunting outlaws and on other occasions they have headed into the Mohave on errands of mercy. The most spectacular of these trips was a sixty mile journey through snow and over two mountains carrying food to a dozen starving miners. As an aid to keeping in touch with each other when roaming through desert wastes the brothers recently added the latest pieces of equipment carried by Lena and Prowler, a pair of midget short wave radio sets. If either brother is in difficulties he can send out an SOS with the assurance that the other machine will soon put in an appearance taking gullies and rocks in its stride.

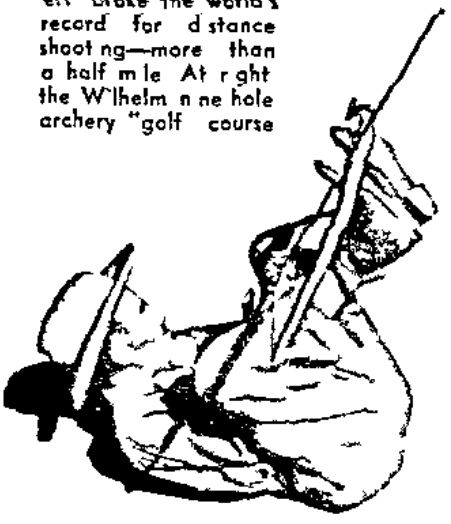
When the going gets really tough and there is obviously danger of Lena or Prowler sliding down a hillside to disaster the boys halt. But not for long.



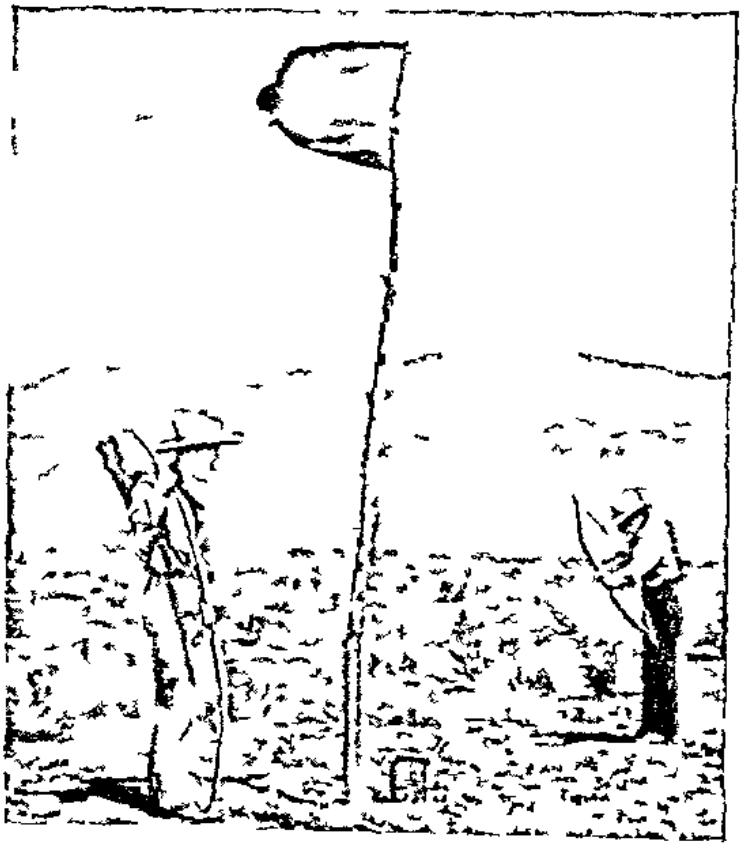
This mechanical deer bounds across the plains realistically providing excellent bow-and-arrow practice

Selecting two straws—one longer than the other, they draw lots. The one winning the draw takes over the wheel and drives.

Climbing a steep mountain one morning they approached a sharp switchback. Out came the straws. Ken won. Before they got out of their fix it was sunset. Yet they set out for more sport like it next day.

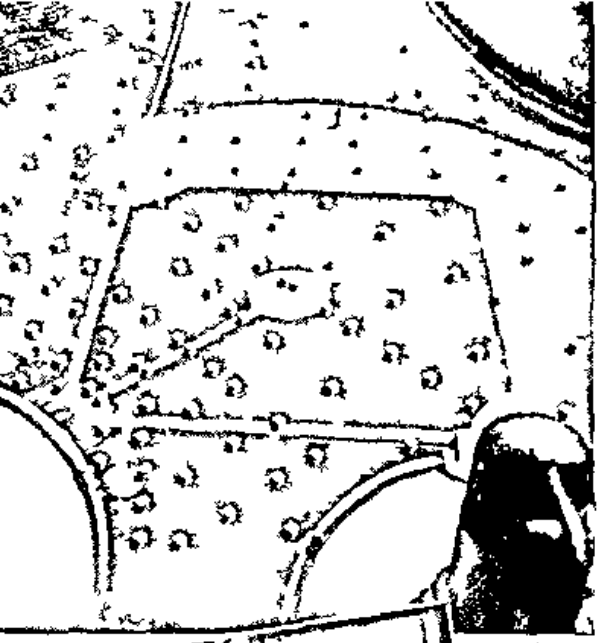


Here's the way Ken Wilhelm after long fanning on the desert broke the world's record for distance shooting—more than a half mile. At right the Wilhelm nine hole archery "golf course"



836 Giant Bulbs Light Diamond

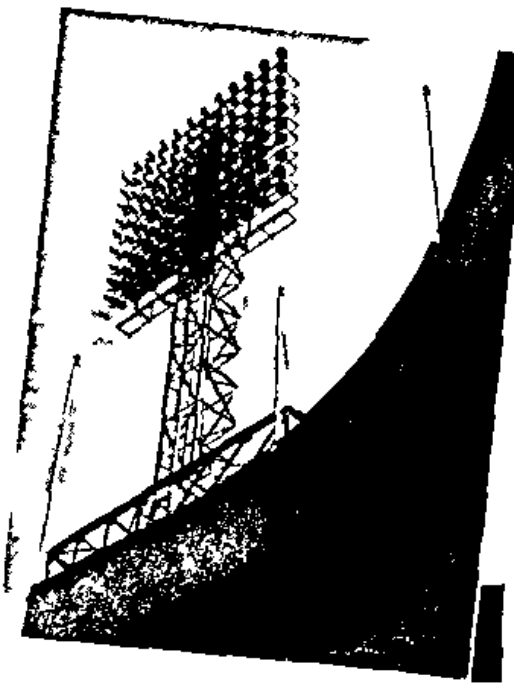
A NEW 200 000 000 candlepower lighting system most powerful on any sports arena in the world turns night into day for baseball players and spectators at the Polo Grounds in New York City Eight steel towers resembling monster telegraph poles rise 150 feet above the New York Giants home field Cross arms carry a total of 836 floodlights each of 1 500 watt capacity To assure the right distribution of lights the cartons of the bulbs were spaced on the field as targets Then Westinghouse engineers using rifle type sights trained each lamp on its mark Strongest illumination falls upon the infield because of its concentration of players and speed of action The light supplied would illuminate 4 000 homes

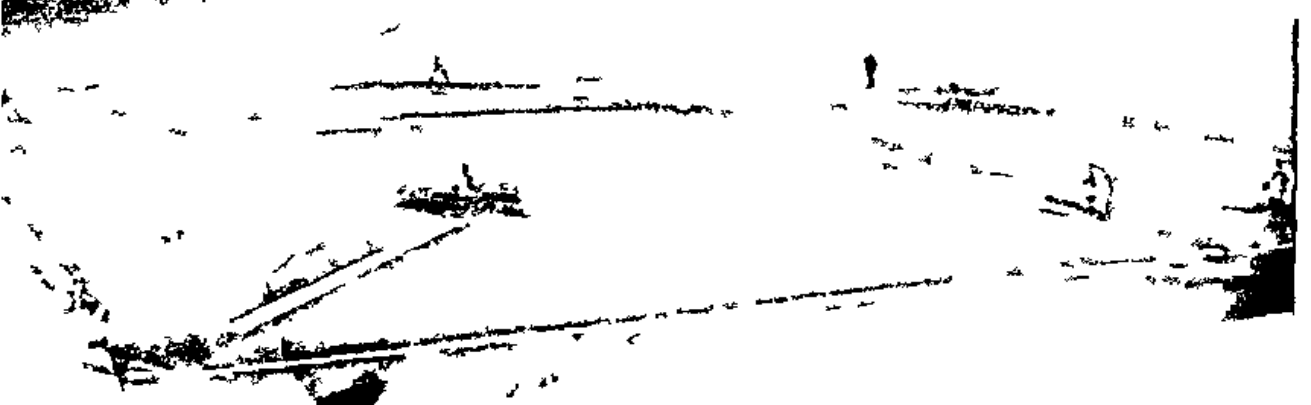


Bulb cartons spotted over the Polo Grounds home field of the New York Giants to guide engineers in aiming powerful floodlights as shown at the left



Eight tall towers like the one seen at the right hold enough 1 500 watt lights to produce a total illumination of 200 000 000 candlepower In the view below the vast arena is aglow for a night game Note the distribution of light





Uncle Sam's Shooting Gallery





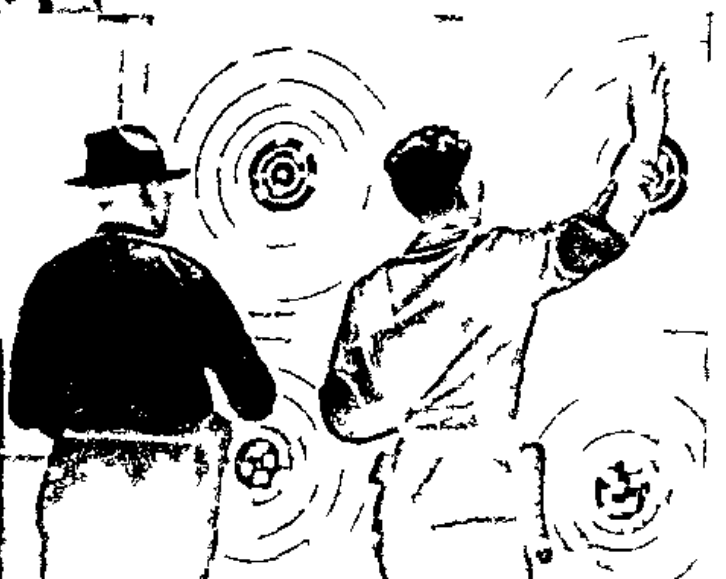
Th ee ma ksmen on the f ng l ne The annual Nat onal R fle Matches at Camp Pe y Oh o n August d aw c ack shots f om the count y o e

AMERICA'S BEST SHOTS RUB ELBOWS WITH DUBS AT GUNPOWDER JUBILEE RUN BY THE U S ARMY FOR SPORT AND DEFENSE

By Edward W Murtfeldt



In the p ts checke s haul down to gets f om the acks to count The h Bul let holes a e patched w th squa es of adhes e pape as shown at the ght



TRAVELING in planes trains buses private cars trucks and even on foot more than 10 000 eager men women and youngsters from all corners of the nation will head toward the shores of Lake Erie in mid August for the largest sporting event in the world The lure that draws this myriad of bankers housewives G men clerks police shopkeepers and citizens from practically every other walk of life is the annual National Rifle Matches sponsored jointly by the U S War Department and the National Rifle Association

In this mammoth gunpowder rodeo millions of rounds of ammunition will be fired from pistols 30 caliber rifles and small bore guns Police will school themselves in getting the jump on criminals Hundreds of beginners will learn how to shoot and how to handle guns safely Marksmanship records will be assaulted historic trophies won and national champions crowned And at the end of the three week bullet jubilee a new group of straight shooting citizens will scatter to their homes to add to the defensive power of the nation and to the world wide reputation of the United States as a country of crack shots

The shooting starts August 18 at the Army's Camp Perry a few miles from the lake town of Port Clinton Ohio Nowhere else in the world I experts state is there a rifle and pistol range that can compare with it Here stretched out side by side for two and a half miles are target ranges of every size from 1 000 yards for 30 caliber rifle competition to twenty five yards for pistol events And around the fringe of the ranges is a far flung city of tents to house the extensive Army personnel required to run the matches and also to accommodate practically all the contestants and visitors

For the matches are open to any citizen of the United States and the Army will put up any American who wants to compete Tents beds and bedding are supplied without charge while a mammoth cafeteria serves meals at low prices For the rifle or pistol fan who would like to bring his family the Squaw Camp a part of the reservation next to the bathing beach is set aside Here a man and his wife can have a floored screened tent with electricity for $1 50 a day Bringing junior along adds just fifteen cents a day to the tent cost

And you don't even have to own a gun for the Army will issue you a 30 caliber rifle or a 45 caliber pistol and furnish all



Part of the two and a half miles of rifle and pistol ranges at Camp Perry In the background is a glimpse of the city of tents that houses thousands who attend



Arms and the woman a trio of fa contest ants Whole fam es like the g oup below attend the matches— and they all shoot too



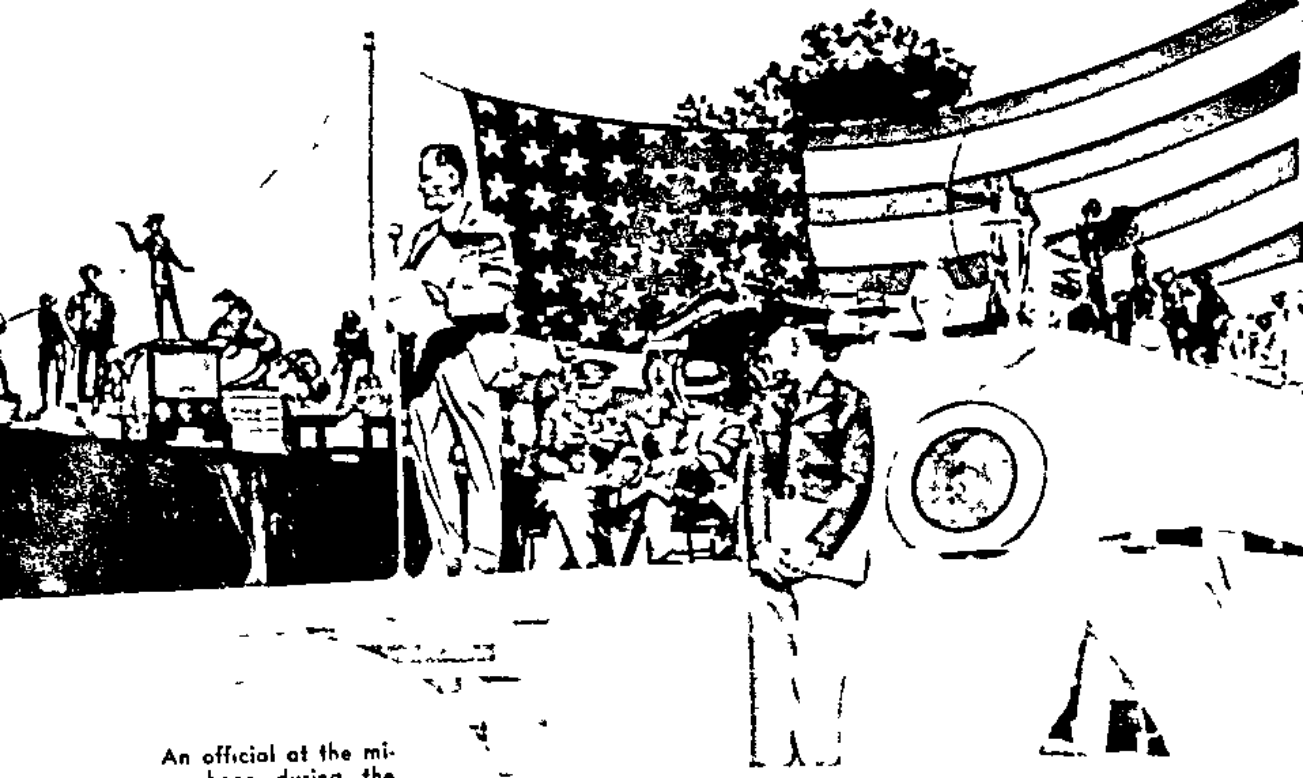
the ammunition you ll need for match firing If you ve never fired a rifle a competent Army instructor will show you how

In addition to the van guard of individual con testants the Perry meet will attract civilian rifle and pistol teams from every state in the union plus teams represent ing the National Guard metropolitan pol ce forces the U S Army Coast Guard and Ma rine Corps the Customs Service the White House police G men and other state and Fed eral agencies Last year almost 5 000 persons competed firing a total of more than 3 000 000 shots

Step out on the range when the matches get under way and you ll see a sight that you ll never forget With the roar of service rifles in your ears you will gape at a two mile l ne of fire Crack marksmen lying prone are battering bullseyes 1 000 yards away Down the l ne under the watchful eyes of sold ers and officers civil ans are getting their first c ance at fir ing the new Garand semiautomatic rifle re cently adopted by the Army

Group by group all along the firing l ne





An official at the microphone during the presentation of medals and trophies. Below the U.S. Marines have landed on the firing line to show the leatherneck style of shooting Many of the U.S services are represented by teams.



the nation s greatest shots together with the dubs and rank tyros are stand ng sit t ng kneeling and lying prone shooting rifles p stols and revolvers at various ranges in timed fire rap d fire and slow fire matches Playing a sharpshooter s swing tune bullets wh stle through the air and *zing into the targets or occasionally k ck* up a spatter as they miss the target and plow into the waters of Lake Fr e beyond the butts

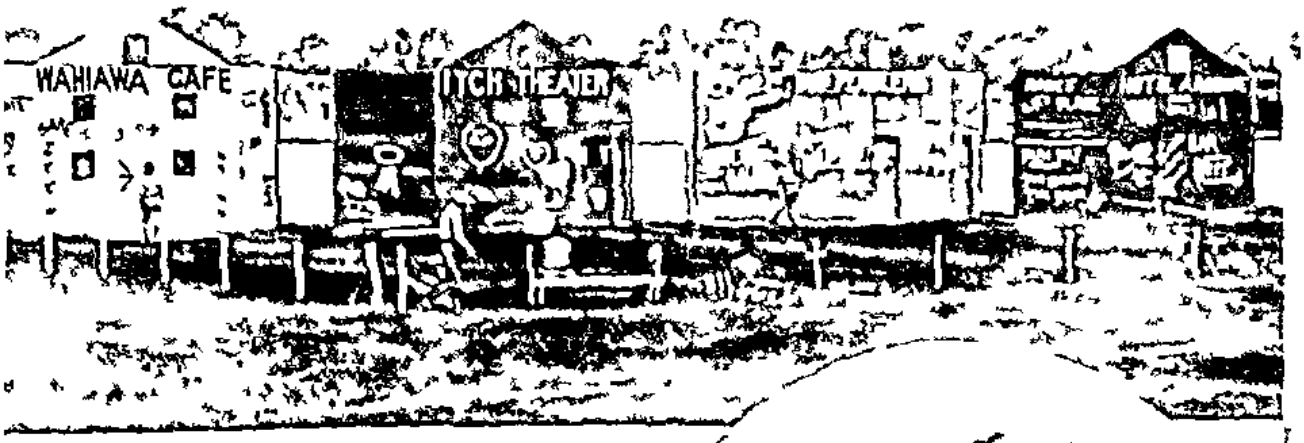
Stroll ng down back of the fir ng l ne or sight ng along the p ts be hind the targets you ll mar vel at the horde of Army of ficers and men needed to con duct all phases of the compe tition You ll note target spot ters range officers scorers checkers computers and mes sengers In the pits the trench back of the butts you ll watch enlisted men haul targets do vn from their racks *in the line of fire for check* ing repair and replacement

Officials estimate that fif teen Army men are requ red for each ten contestants in order to run the matches in the smooth efficient and safe manner for which the meet is famed An ndication of ho v Army super s on makes for safety is found in the fact that only two casualt es have occurred in twenty one years of match fir ing at Camp Perry

Down at the left of the range you ll w t ness one of the most interesting phases of the Perry matches—the National Pol ce School where representatives from pol ce departments in all sections of the country *are schooled in the latest methods of pol ce* science and sent back home as qualified in structors to their fellow officers in the home forces Subjects studied in the full week course include disarming an attacker shoot



How to d sa m an opponent as demonst ated at the Nat ona Pol ce School In the p cture below c v l ans are a owed to t y the A my s new Garand fle



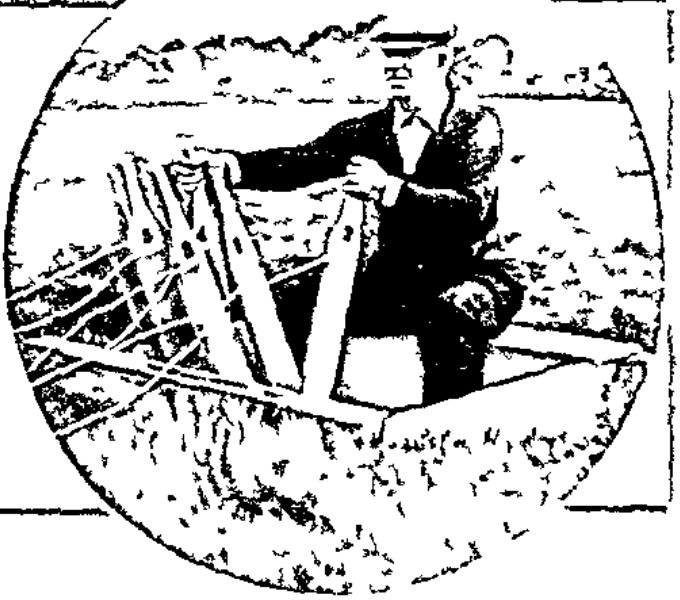
Hogan s Alley a featu e of the Pol ce School S lhouette targets controlled by levers seen at r ght appear in w ndows of the dummy bu ld ngs

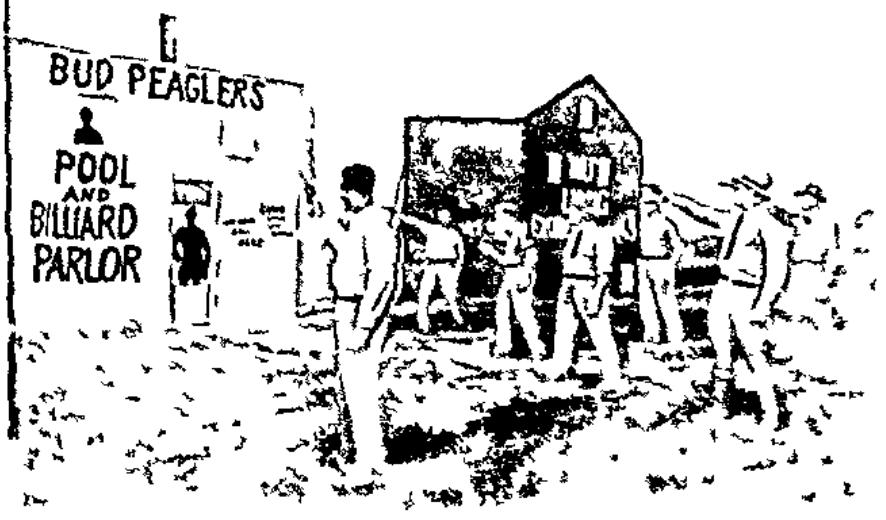
ing at rap dly d sappearing targets using tear gas and the Th mpson submachine gun hand to hand fighting and the fun in mentals of j jutsu

Here at the Police School is the famous Hogan s Alley a curious group of backless bu lding fronts representing the dilapidated frame structures lining one side of the main street of Buckt wn Gulch Ariz as t appeared in 18"9 By means f a ser es of hand levers an l attache l cables silhouette figures are popped suddenly int the w ndow or door openings of Bud Peagler s Pool Parlor or the Wa hawa Cafe wh le police try to drill them with pistol bullets before they disappear two seconds later

Near by is a repl ca of the rear of an automobile Traveling on an overhea l trolley it speeds away as pol ce fire at it in attempts to blow a rear tire Sim lar in operation is a run ning man target which crosses the officers line of fire at an angle from left to right

The value of this police training is dramatically revealed by the experience of the Detroit Mich po lice who have sent repre sentatives to the school for years When they first started an average of four policemen lost their lives for every criminal kille l in Detroit Today the average is one policeman to every eleven criminals





A hot gun battle in the Alley S nce the targets appear unexpect edly and van sh n two seconds t takes good shoot ng to h t one

At the opposite end of the range from the Police School you run across hundreds of youngsters from eight to eighteen some of whom will shoot it out for the national jun

ıor champıonsh p of the nat on and some of whom are barely b g enough to hoist a r fle to the r shoulders A U S Marine is ass gned to each of these neophytes to give h m expert nstruction in the rud ments of rifle shooting and gun handl ng Before the youngster comes out from under the w ng of his leatherneck gu de he w ll have learned not only how to shoot a gun and handle it safely but also how to clean it take it apart and put it back together aga n

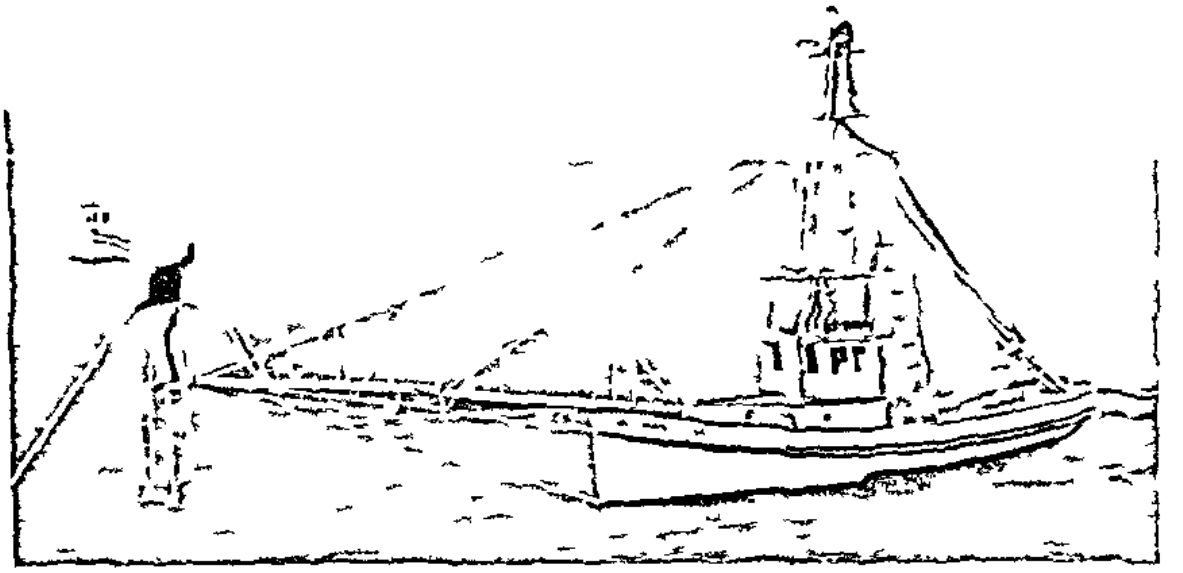
Truly a giant training ground for the development of the art of shooting in all its phases from the instruct on of future sharp shooters to the reward ng of record breaking feats of marksmansh p the annual Camp Perry meet has had much to do w th the establ shment of shooting as one of the most popular American sports And now w th nat onal defense of primary impor tance Perry s influence may prove to have been of even greater value than that of a clean wholesome sport in building up the armed might of the United States

Quee gadget I ke the balanc ng de ce at the ght appea at e e y meet ng The boys below a e lea n ng a l about guns f om a U S Ma ne



Rap d f e on a 200 ya d range Camp Pe ry helps keep Ame ca a na on of sk ful ma ksmen

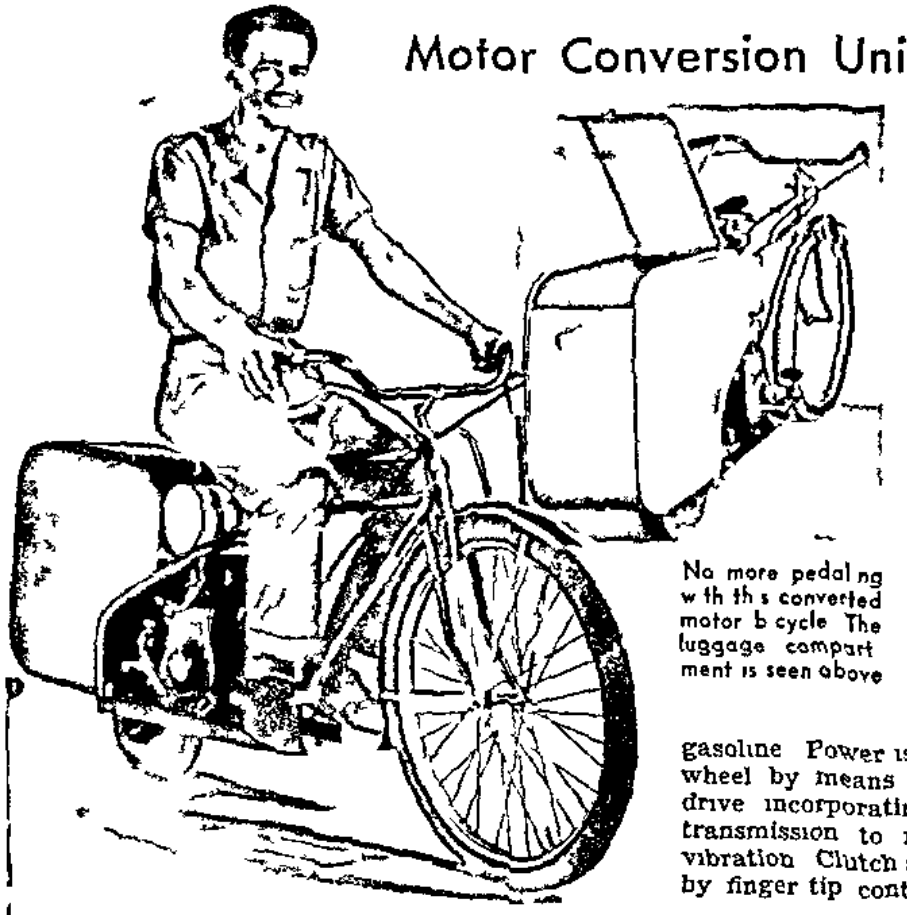
Fishing Boat Steered from Crow's Nest



When the lookout sights a school of fish he can run the vessel toward it by controls atop the mast

ONE man can act both as pilot and lookout aboard the fishing boat *Santa Lucia* of Santa Barbara Calif In the crow s nest of the vessel two control wheels are connected by means of long rods with the steering mechanism and engine below The pilot can thus steer his craft toward any school of fish he sights from his lookout.

Motor Conversion Unit for Bicycles



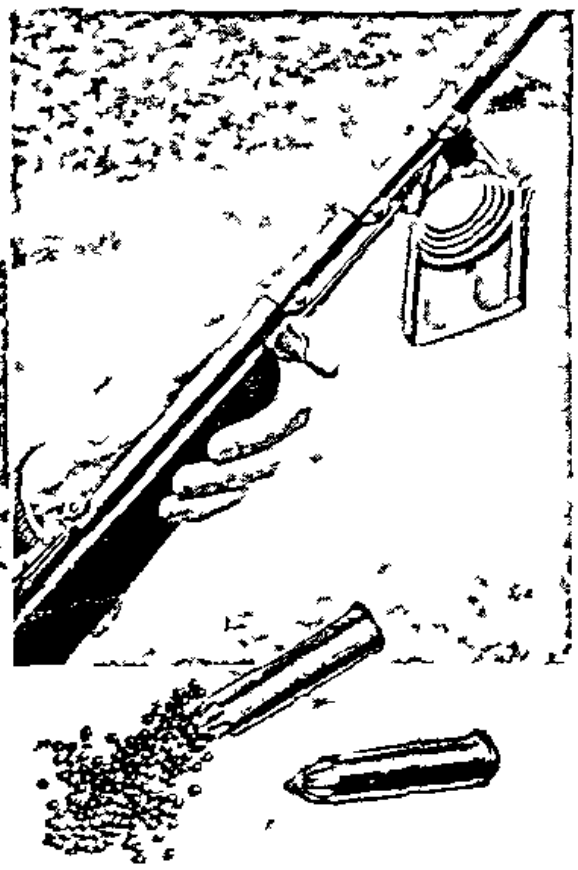
No more pedaling with this converted motor bicycle The luggage compartment is seen above

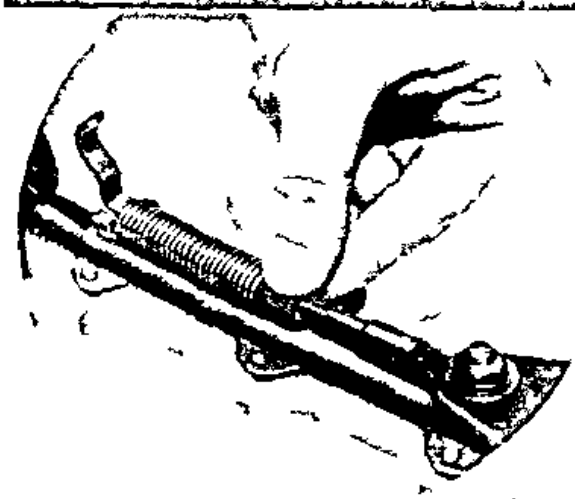
BICYCLES can be converted into motorized vehicles by means of easily installed units just introduced The rear wheel of the bicycle is removed and replaced by the unit pictured at the left which includes an engine drive mechanism small rear wheel and special luggage compartment Rated at one and a half horse power the four cycle air cooled motor is equipped with a kick type starter and drives the wheel at speeds up to thirty miles an hour running more than 100 miles on one gallon of gasoline Power is transmitted to the rear wheel by means of a specially designed drive incorporating a chain and V belt transmission to reduce road shock and vibration Clutch and throttle are operated by finger tip controls on the handlebars

Trap on Gun Hurls Clay Targets

WEIGHING only fourteen ounces and clamping to the barrel of al most any 22 caliber smoothbore or 410 shotgun a simple spring trap for throwing small clay tar gets makes possible an exciting new shooting game The fore finger of the left hand presses the target release sending the clay disk skimming away wh le the forefinger of the right hand oper ates the trigger of the gun. At a d stance of fifty feet the tiny pellets of a 22 long rifle shot shell will break one of the clay disks According to the inventor I O Mossberg of New Haven Conn such one man trap shoot ing can be practiced safely in any 300 foot open field since the *range of the shot is short.*

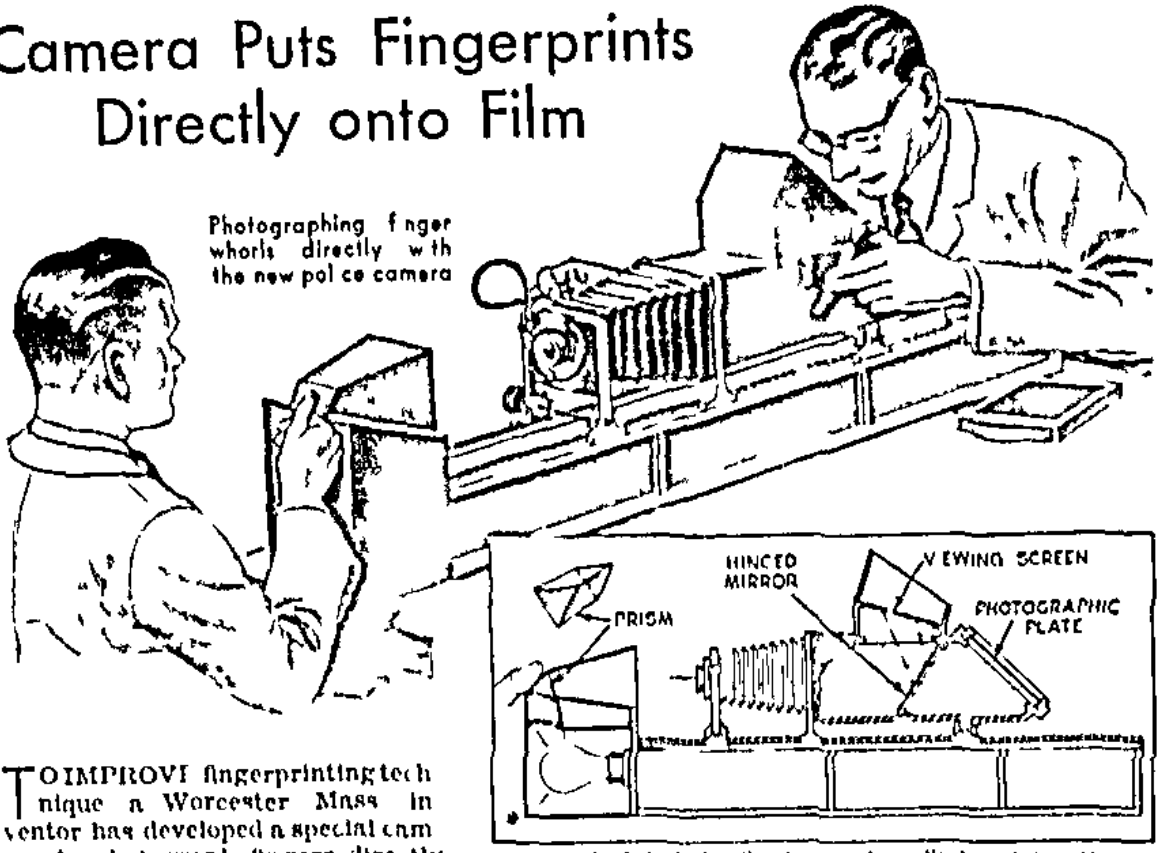






Any open f'eld becomes a t ap-shoot ng range w th this new game for sportsmen Above how the t ap s attached to the gun ba el and scatter-shot shells used w th a 22 cal ber smoothbo e T ap sp ng can be ad usted for speed and d stance as llust ated at left

Camera Puts Fingerprints Directly onto Film

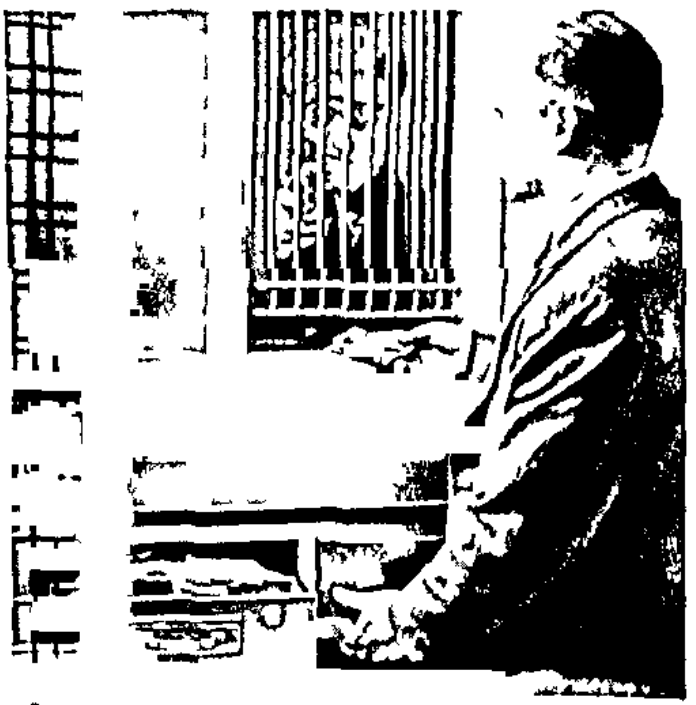


Photographing finger whorls directly with the new police camera

How a built in light illuminates the telltale print pattern

TO IMPROVE fingerprinting technique a Worcester Mass inventor has developed a special camera to photograph fingers directly to obtain prints The subject places a finger against one side of a prism set into one end of the apparatus Light from an electric bulb in a special housing shines into the prism and reflects the finger image through the lens of an adjustable reflex type camera for focusing and photographing Side lighting brings out details of the print clearly while by eliminating the need for an inking pad the apparatus removes the danger of smeared prints

Bank Teller's Cage Has Fourteen Ways To Foil Holdups



By pressing a concealed button the cashier gives the alarm

NO MATTER what tactics a robber may attempt the teller in the special bank cage pictured at the right has a card up his sleeve to foil him Installed in the demonstration room of a company manufacturing protective devices for banks stores warehouses and other places of business the cage is equipped with fourteen separate electrical devices most of which are hidden and capable of secret operation while the teller apparently obeys the orders of his armed customer In the photograph the teller is shown operating an alarm button under the counter with his left hand while handing over cash with his right



Pour ng shot into the funnel a l ttle at a t me Tyrrell pulled the we ghted penc l along the tablet w th a p ece of str ng

Is It Murder?

By EDWIN TEALE

How Scientific Sleuths Uncover Hidden Clews to Trap Clever Killers Who Plot "Perfect Crimes"

AT FIVE minutes past eleven on the night of April 18 the crash and rumble of an elevated train muffled the quick double report of a revolver on the upper floor of a New York rooming house The next morning a housekeeper found the bodies of a man and woman sprawled on the floor both shot through the head Between the two where it appeared to have dropped from the stiffened fingers of the man lay a blue barreled, .32 caliber revolver Appar

ently, the tragedy was a murder and suicide

That is the way the verdict might have stood, but for one of the newest strings to the bow of scientific crime detection. In New York City as part of their regular procedure, detectives now obtain blood samples at the scene of every crime of violence In this instance such samples quickly erased "suicide from the report and left the one ominous word 'murder'

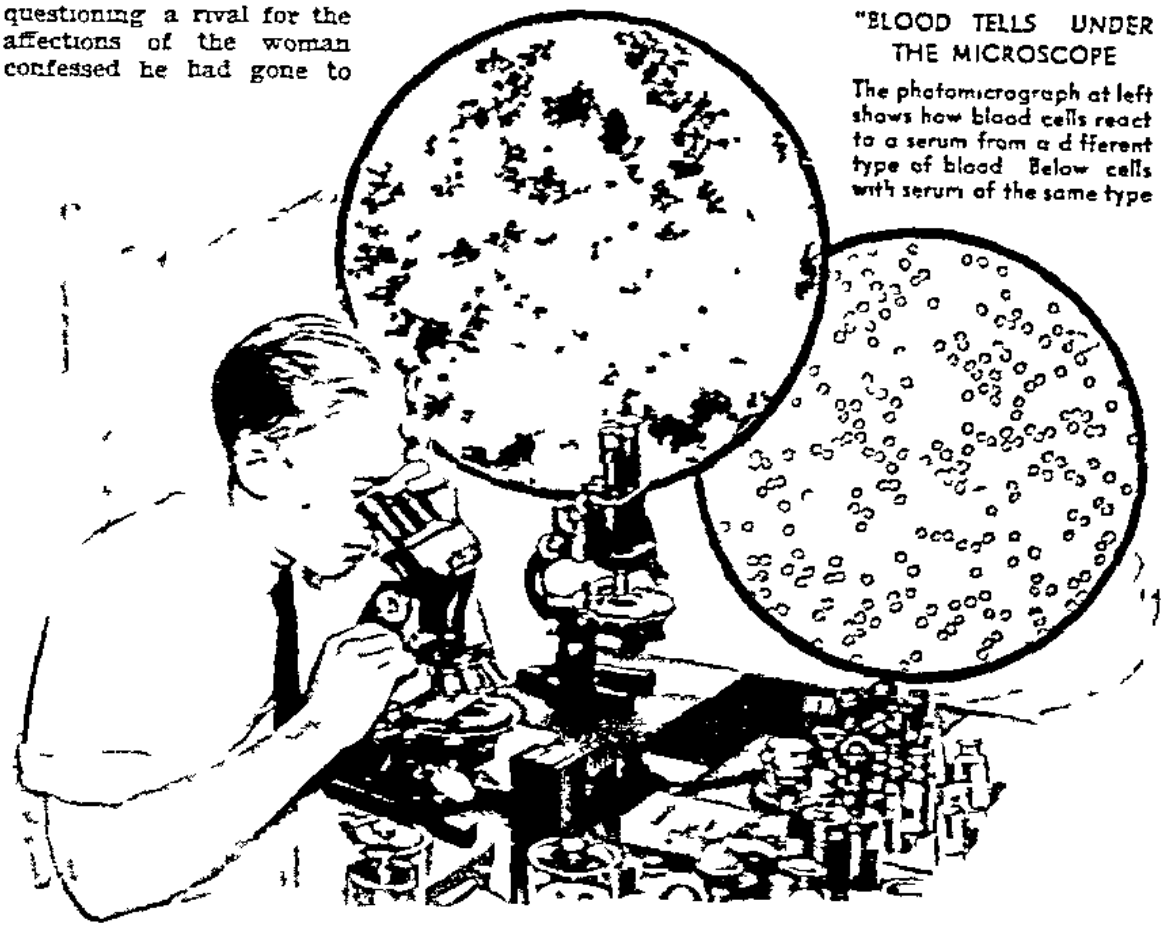
A laboratory detective, skilled in the use of serums, studied the blood samples with test tube and microscope As a result of recent research at the Rockefeller Institute and in other laboratories seventy two groupings of fresh human blood are now recognized under the four main types A B AB and O Through the reaction of specimens and serums the detective ascertained that the woman had type B blood the man type A. Samples of small, fresh stains on the floor of the death room, however gave an entirely different reaction. They had been produced by type O blood and could not have come from the life stream of either victim. A third, unknown, injured person had been in the room on the night of the tragedy'

That laboratory clew set detectives of the homicide bureau digging into the past lives of the victims Under questioning a rival for the affections of the woman confessed he had gone to the room, had been slashed in a quarrel and had shot both the man and woman. Then, after wiping fingerprints from the revolver, he had planted it to suggest a suicide

Oftentimes cunning and cold blooded killers seek to hide their crimes by such a ruse Exposing these murders disguised as suicides is one of the dramatic jobs of the scientific sleuth.

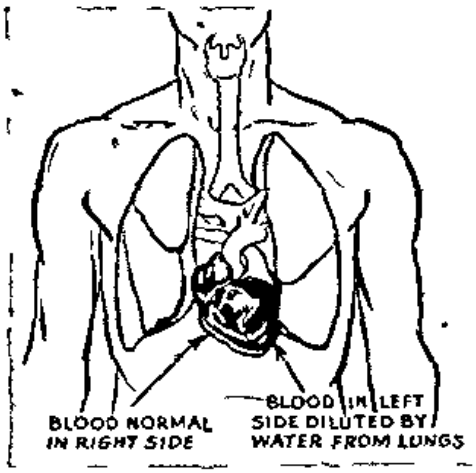
In this work, present-day crime fighters are making use of many of the resources of science They are putting paper, hair rope handwriting fingerprints through a scientific third degree They are employing spectroscopes to reveal the presence of metals and drugs They are using polarized light to make crystal patterns stand out vividly under the magnifying lens They are operating comparison microscopes to bring the images of two bullets or bits of metal together so that scratches can be compared. In some instances the reaction of chemicals placed on a victim s hand has proved he did not fire the weapon he held. In other cases a comparison of revolver-barrel markings on bullets showed that the victim was killed by another pistol rather than the one found clutched in his hand.

The old expression "Blood will tell!" has been given a new twist by present-day crim-



"BLOOD TELLS UNDER THE MICROSCOPE

The photomicrograph at left shows how blood cells react to a serum from a different type of blood Below cells with serum of the same type



DID DROWNING OCCUR IN SALT WATER?

By comparing the amount of salt in the blood in right and left sides of the heart scientific detectives can determine whether a drowning victim died in fresh or salt water This test often unmasks criminals who have planted a body in order to counterfeit a suicide

inology in unraveling mysteries of simulated suicide Even the tiniest drop of this vital fluid is often enough to reveal important clews that will lead to a solution

A few months ago noon hour shoppers in a *midwestern city* screamed and scattered The body of a man had plunged from an upper story window of an office building It hurtled downward and struck the sidewalk The first doctor to *reach the scene pro*nounced the man dead, evidently a suicide

Three hours later, this simple explanation was shattered by an alert assistant at the local morgue He had noticed that there was no blood in the lungs, a condition characteristic of deaths by falling The implication of that discovery was plain The victim had been dead before the fall from the office window A swift police investigation followed It revealed that a dissolute business associate after killing the victim had pushed the body from the window He had relied upon the spectacular plunge into the crowded street below to hide his crime

One of the most ingenious advances in recent criminology is a blood test devised by the noted New York toxicologist, Dr Alexander O Gettler It tells almost infallibly whether a drowning victim met his death in salt or fresh water From the lungs blood goes directly to the left *side of the heart where* it is pumped through the circulation system of the body, returning to the right side of the heart Normally, this blood contains a certain percentage of salt When drowning occurs in sea water, the lungs fill with brine



Investigation revealed that a business associate killed the man and threw his body from the window

before death takes place and the salt content of the blood on the left side of the heart is increased When death occurs in fresh water, this blood is diluted and so contains less than the normal amount of salt. Simply by taking samples from both sides of the heart and determining the salt content of each, the scientific sleuth now can prove instantly, in suspicious cases whether death occurred in salt or fresh water In other drowning cases microscopic water-borne clews have been instrumental in spotlighting murder plots disguised as suicides

FOR example, a few years ago, boys out hunting gophers entered an old barn standing in a hayfield near a river Within they found the body of an elderly man hanging from a crossbeam All evidence pointed toward a suicide until a scientific detective set to work with his microscope Beneath the victim s finger nails and in his lungs, he discovered diatoms or subvisible algae found in fresh-water streams and ponds This clew—too small for human eyes to see—provided a key that unlocked the mystery of an amazing murder The elderly victim had been drowned Then his clothes had been changed and his body hanged in the barn in what his slayers imagined was a complete obliteration of all evidences of their guilt.

Sometimes the microscope joins forces with the test tube in exposing a suicide slaying In Ohio, not long ago, a woman was found dead, poisoned by arsenic Her husband contended that she had taken her own life, and exhibited a half-empty box of vermin eradicator which he said she had used About this time, evidence came to light that, a week before, he had purchased a different type of this same deadly poison Had the victim met her death by taking the rat poison as he said, or had he murdered her with the arsenic he had bought? The answer hinged on tiny crystals found in the stomach of the victim The test tube proved they were arsenic Under polarized light, the microscope next revealed brilliant triangular facets entirely different from those in the vermin compound Tripped up in his story, and confronted with this evidence, the slayer confessed.

In the drug-crazed mind of an eastern dentist, some years ago, there hatched one of the most diabolical poison plots in the annals of premeditated murder His father-in law had taken out life insurance in his favor To collect this money, the dentist pretended to fill a large cavity in one of the older man s teeth Packing it full of the deadly drug aconite he covered it with a thin temporary filling During the night, this filling dissolved and the victim died in agony before morning The indication, as the murderer expected, was that the dead man had taken his own life In analyzing the stomach content, however, a toxicologist discovered minute fragments of undissolved dental wax. Suspicious, he instituted an investigation It resulted in the slayer s conviction



To collect insurance a dentist filled a cavity with a deadly poison covering it with a temporary wax coating

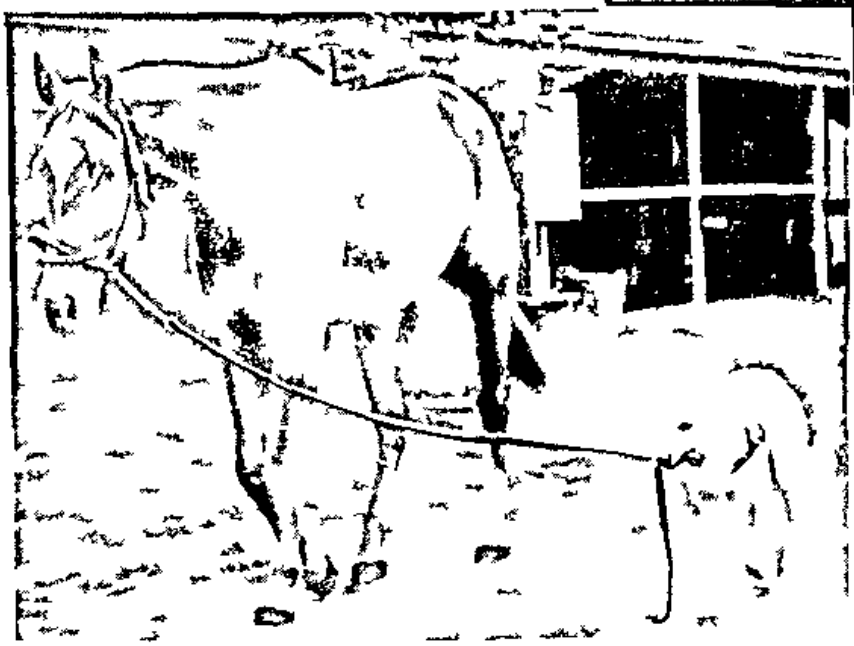
To save precious minutes in dealing with Borgia killers, scientific detectives in several large cities now employ spectroscopes to analyze unknown poisons In a fraction the time required for chemical tests such mechanisms enable them to determine the drug that caused death In the spectroscope, each chemical element produces its own distinctive lines of color

IN ADDITION to spectroscopes, to polarized light, to the more elaborate tools of scientific crime detection the investigator on the trail of a fake suicide slayer often has to devise original apparatus of his own to prove his point An outstanding instance of the kind occurred during the celebrated "phantom will case at Ladysmith, Wis

Shortly after a wealthy widow remarried she died of poison Her husband brought forth one of the strangest documents ever offered as evidence in a law court—a combined suicide note and will which had been written neither *(Continued on page 221)*

Canine Stable Boy Helps Train Racer

HIGH STRUNG temperamental race horses often have mascots whose playful companionship provides a diversion from the serious business of winning turf events Witness for example the friendship of Baranca a thoroughbred and Flash a pure white dog In the circle at the right the



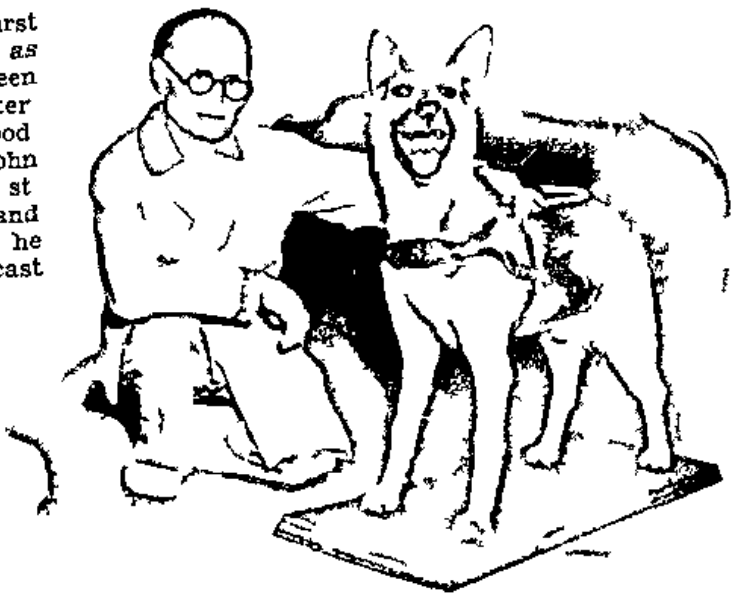


trained mascot offers the racer a juicy carrot and at left he holds the halter and leads Baranca out for a light workout at the rInglewood Calif home Winner of his share of races the horse could lead the dog a merry chase if he chose to set the pace nstead of meekly obeying the or*ders of his affection*ate canine trainer

Fah the dog ma at leading Baan a out fo a wak In the cle at uppe ght the ace ho e accept g a ca ot f om h can e f end

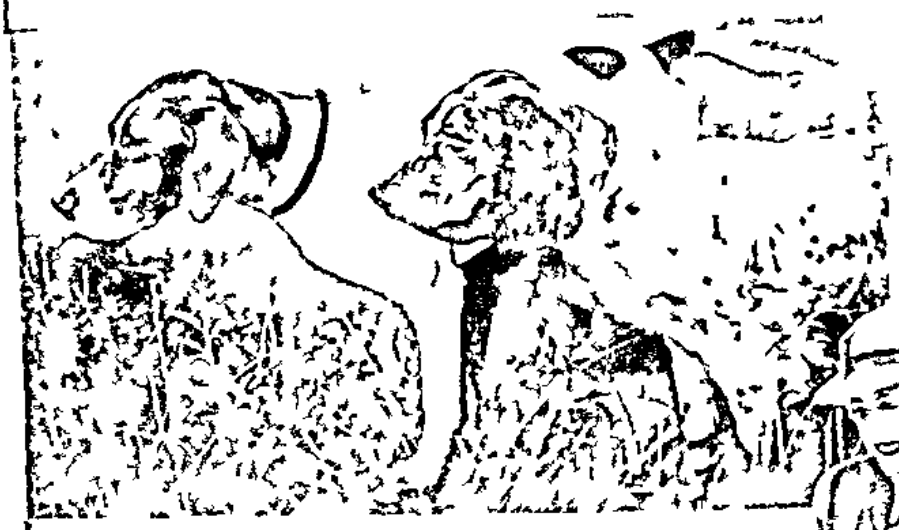
Pioneer "Seeing Eye" Dog Is Preserved

ALMO said to have been the first *police dog brought to this country as* a seeing eye for the blind has been preserved as in life for his master Dr W A Christensen of Hollywood Calif When the animal died John M Schlesser California natural st first measured him both before and after the skin was removed Next he modeled Almo in clay made a cast over the clay and inside this cast molded a form of paper mâché Then he fitted the skin which had been tanned and mothproofed over the form Finally he returned the original jawbone and teeth to the mouth Wearing his harness as shown at right Almo now looks as alive as when he trotted across Hollywood street intersections ahead of his master



FIELD TRIALS TEST

Champion Hunting Dogs



Two hunting dogs a pointer and a setter freeze on a game bird Correct form in pointing equires head and tail to be above the line of the back as illustrated below

By ALLEN DONOVAN

SIXTY SIX years ago on the eighth of October the first American field trials for hunting dogs took place near Memphis Tenn Today sporting calendars record such events in all parts of the country Annually hundreds of thousands of spectators watch various breeds of dogs such as pointers and setters beagles basset hounds dachshunds foxhounds spaniels and retrievers compete under varying rules for honors and awards

The whole purpose of a field trial is to determine which animal possesses in *the highest degree qualities of value to* the hunter A field trial is not a beauty contest to pick the handsomest dog It is not a race to see which animal can cover a given course in the least time It is not even a competition to discover which dog can find the most game The judges watching the animals at work list their ratings under such headings as speed stamina style intelligence and courage

Usually the dogs compete in packs or in braces which consist of two animals running at the same time They have from half an hour to three hours in which to cover a given area and find or retrieve game which has been released beforehand The manner in which the dogs handle themselves in the field is the basis of the judges decision Centuries of breeding and years of scien

tific training comb ne to produce the win ners

The earliest dogs to compete in Ameri can field trials were pointers and setters animals which rigidly point toward game as soon as they scent it Such contestants are still among the favorites of field dog fan ciers To watch these hunting dogs in ac tion I recently drove to Clinton N J where the Jockey Hollow Club was hold ing one of its celebrated field days for field dogs

Two black and white pointers were zig zagging through the weeds when I drove up to the 1 000 acre state owned shooting grounds In this type of competition the dogs hunt for pheasants or quail released on the course At Clinton the three mile circuit ranges through open fields along a bush covered hillside through heavy woods and out onto a lowland meadow cut by a winding stream Handlers di rect the dogs while the judges follow close behind on horseback

Along the hillside the black and white pointers cut sharply back and forth while the handlers called them in or urged them out with sharp blasts of their whistles One blast usually means Come in two blasts Go on To elim inate confus on handlers often use wh stles of differ ent pitch

Wh le the dogs are work ing westward through bril liant hued bushes the judges are jotting down their notes watching especially such points as thoroughness and scenting abil ty The latter quality is of prime importance

A few years ago a brilliant young po nter in the South won fourteen victories in a single season He seemed destined to be come one of the greatest dogs in field trial history Then at one contest, an insuffi cient number of kennels was provided The young dog was kept overnight in a garage and during the evening someone carelessly ran a motor The fumes from the exhaust affected the delicate nose of the pointer ruining its career

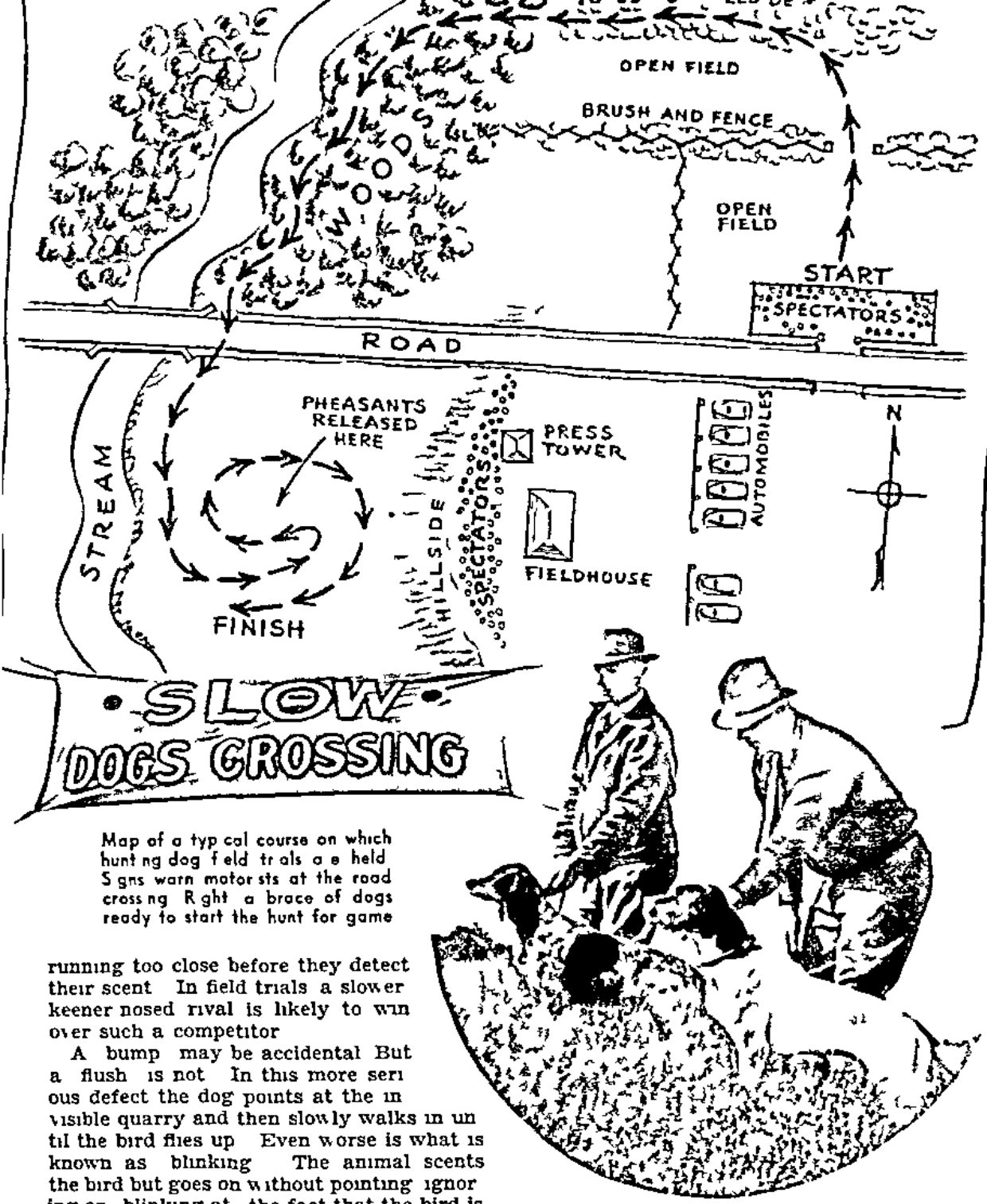
Some dogs trainers have found are too fast for their noses They continually bump birds scaring them into the air by

For f eld t als pheasants are re leased from cages l ke th s Pull ng a ope opens the door and the b rd comes out to h de



HOW TO MAKE A BIRD DIZZY

Somet mes pheasants a e t ed n patches of b ush for dogs to f nd To make them stay qu et they are f st made d zzy by tuck ng the r heads unde the r w ngs and wh l ng them around as shown at the left



Map of a typ cal course on which hunt ng dog f eld tr als a e held S gns warn motor sts at the road cross ng R ght a brace of dogs ready to start the hunt for game

running too close before they detect their scent In field trials a slower keener nosed rival is likely to win over such a competitor

A bump may be accidental But a flush is not In this more serious defect the dog points at the invisible quarry and then slowly walks in until the bird flies up Even worse is what is known as blinking The animal scents the bird but goes on without pointing ignoring or blinking at the fact that the bird is there Blinking is fatal in a contest So is interference Here the dog cuts back and forth in front of its rival or rushes in and flushes a bird at which the other dog is pointing

How long a bird dog will remain rigidly pointing at the spot where he scents game is a question hotly debated among sportsmen At one recent meet a trainer lost sight of his dog He hit him again and again with blasts of his whistle Finally after thirty five minutes of searching he discovered the animal standing rigid among thick bushes pointing at a clump containing game birds

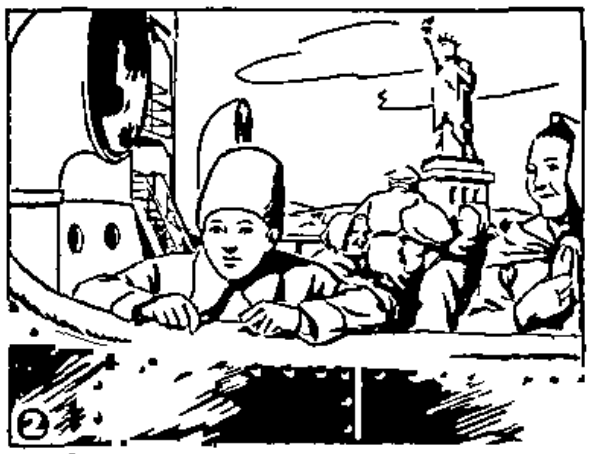
The distance at which such dogs can catch the scent of the quarry depends upon weather conditions as well as the direction of the wind Some years ago in England a noted dog trainer named H M Budgett made exhaustive tests of *(Continued on page 217)*



Here's My Story



DAVID SARNOFF SPENT THE FIRST NINE YEARS OF HIS LIFE IN WEST CENTRAL RUSSIA, WHERE HE WAS BORN ON FEBRUARY 27, 1891



WHEN HE WAS NINE YEARS OF AGE, HE CAME WITH HIS FAMILY TO THE UNITED STATES YOUNG DAVID WAS THE ELDEST OF FIVE CHILDREN



THE DEATH OF HIS FATHER A FEW YEARS LATER MADE HIM THE FAMILY BREADWINNER, SO HE STARTED SELLING NEWSPAPERS IN DOWNTOWN NEW YORK CITY



TO SUPPLEMENT THE SMALL AMOUNT HE MADE SELLING PAPERS, HE GOT A JOB AS MESSENGER BOY FOR THE COMMERCIAL CABLE COMPANY

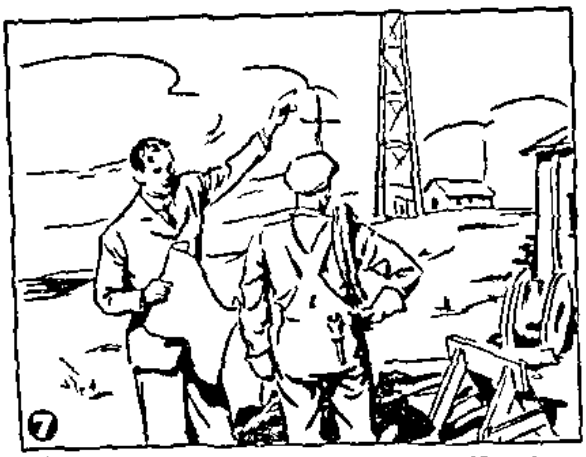


FINALLY, HE LANDED A FULL-TIME JOB, AT $5.50 A WEEK, AS A MARCONI COMPANY OFFICE BOY AT NIGHT, HE PRACTICED CODE ON AN OLD SECONDHAND TELEGRAPH SET



IN 1908 HE GOT HIS FIRST ASSIGNMENT AS A WIRELESS OPERATOR IN THE LONELY MARCONI STATION ON NANTUCKET ISLAND OFF THE COAST OF MASSACHUSETTS HE SPENT HIS SPARE TIME IN THE STATION LIBRARY READING TECHNICAL BOOKS

THE INSPIRING CAREER OF DAVID SARNOFF



He wanted to study electrical engineering at Pratt Institute in New York so he asked for a transfer to the Seagate N Y station this meant a $10 cut in salary but shortly he was promoted to station manager



When he was twenty years old he served as wireless operator aboard the *S S BEOTHIC* on a sealing expedition in the Arctic



In 1912, as a New York Marconi station operator, he picked up word that the *S S TITANIC* was sinking he stayed at his key for 72 hours and gave the world the first authentic news of the disaster



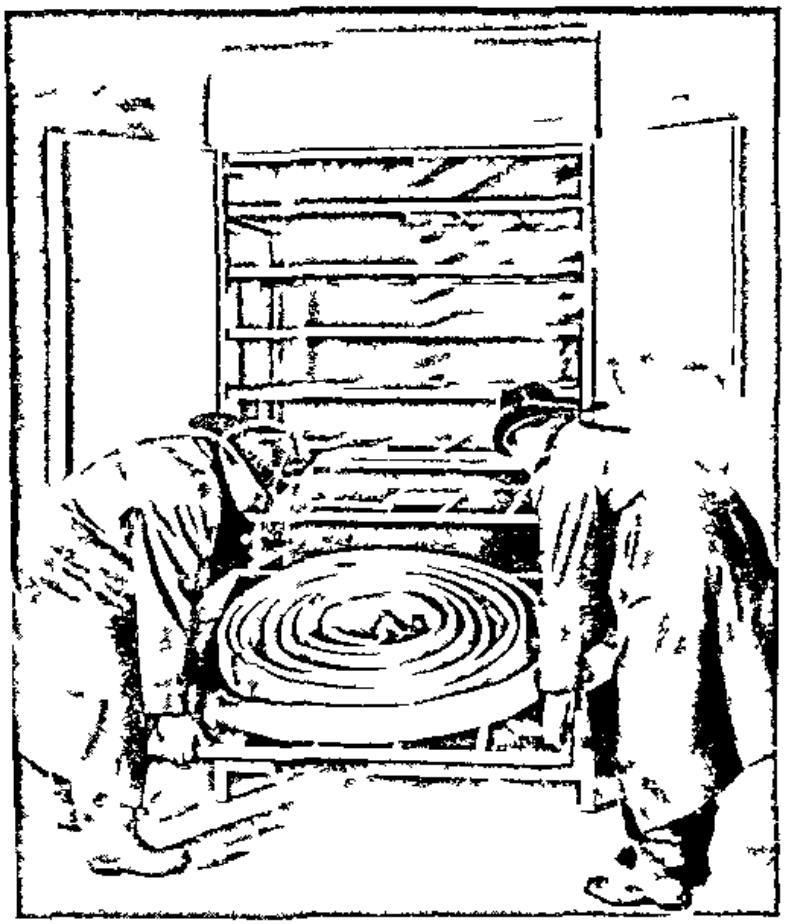
While commercial manager of the Marconi Company in 1915, he recommended developing a "radio music box" this turned out to be the forerunner of our modern home radio receivers



In 1919, the Radio Corporation of America absorbed the *Marconi Company*, and Sarnoff was made commercial manager of the new, enlarged concern



At 39, David Sarnoff became president of RCA today he also heads the National Broadcasting Co, is a director of the Metropolitan Opera and other important organizations, and holds many honorary university degrees

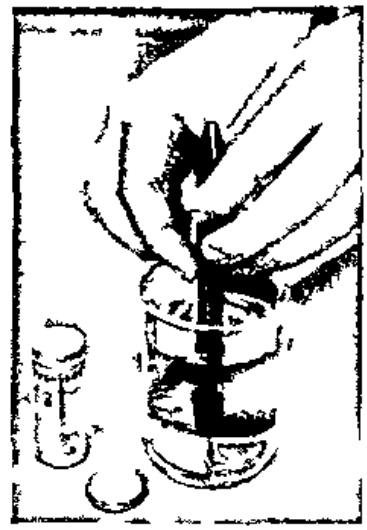


Hot-Air Cabinet Dries Fire Hose

AN AIR CONDITIONED cabinet of new design makes short work of drying fire hose Drawn into the machine air passes over electric heaters and then circulates through the loosely co led hose resting on shelves The indirect heating is said to avoid possible damage to the hose and the un t saves the t me and work of hanging it up in a drying tower

Fountain Pens Kept Clean by Chemical Bath

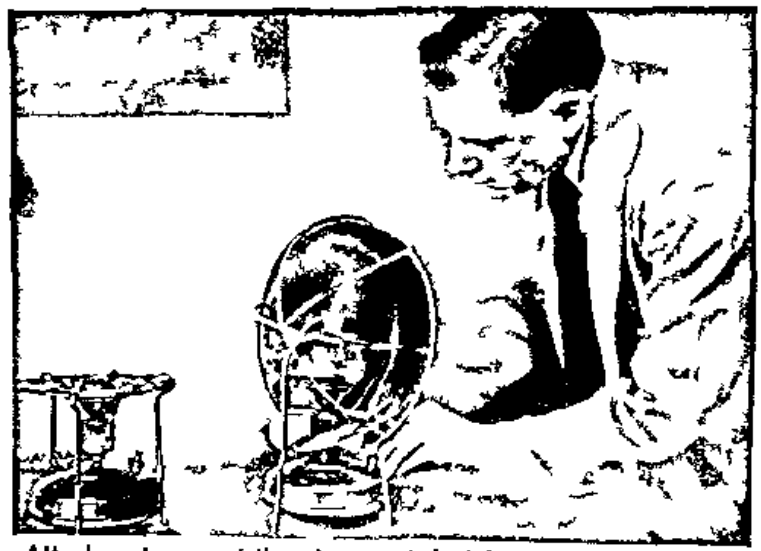
CHEMICAL baths for fountain pens are claimed to clean the parts and keep the rubber sacs in good con dition When a measureful of the flaky white clean ing compound has been dis solved in warm water the pen is immersed in the so lution which is circulated through the interior by working the self filling lever A can of the cleaner holds enough for fifteen baths



Flush ng a founta n pen n the solut on of chem cal n water

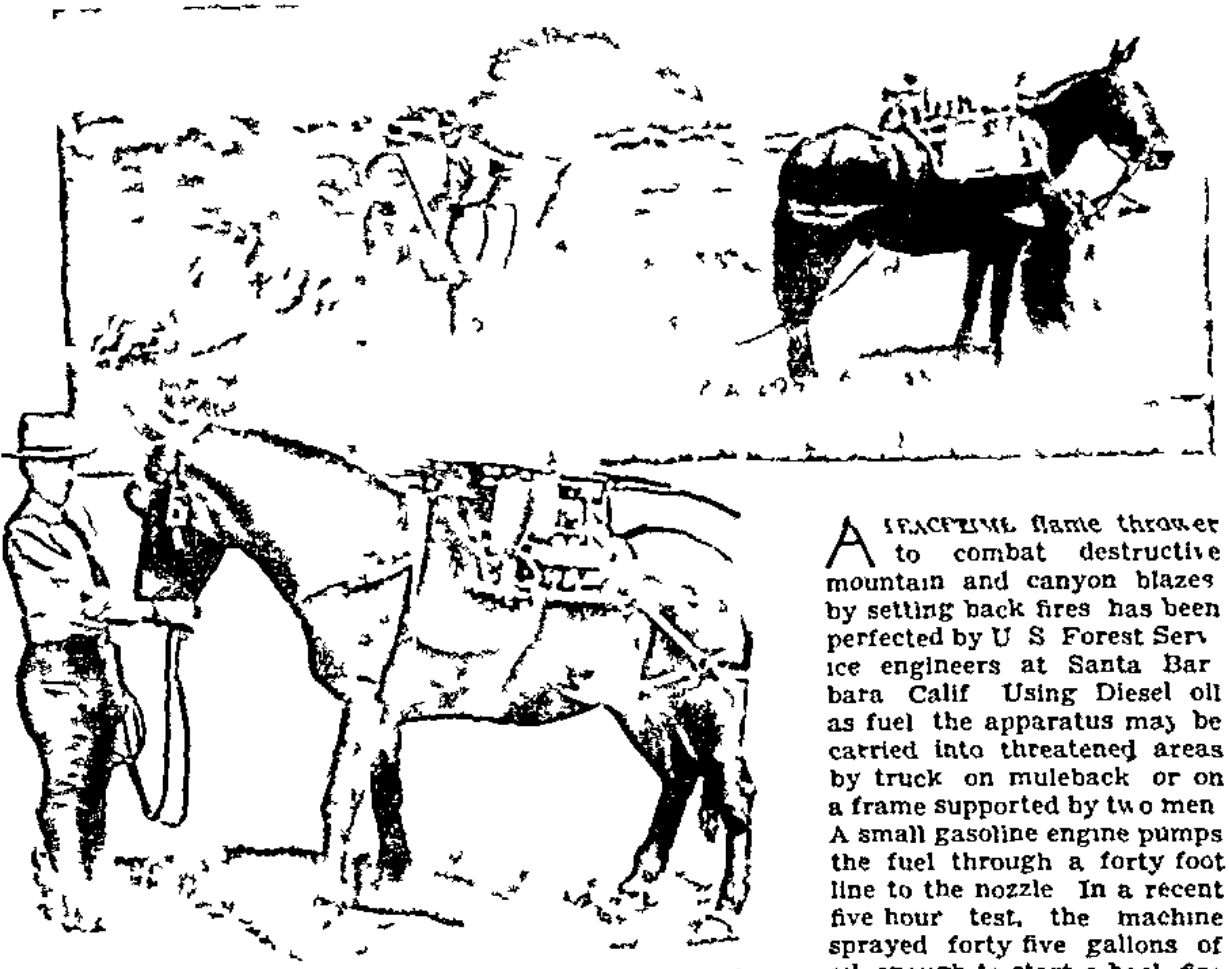
Oil Heater and Stove Combined

ESPECIALLY suited for cab ins of small boats where space is at a premium a one burner kerosene stove and a radiant heater have been combined in a s ngle compact assembly For use as a heat er the burner is fitted with a perforated iron ball which becomes intensely hot A concave reflecting surface concentrates the heat rays in the desired d rect on In the accompanying photo the convertible unit is shown as a stove and as a heater



Attachments conve t the o l stove at the left nto a ad ant heater

Flame Thrower Helps Fight Forest Fire

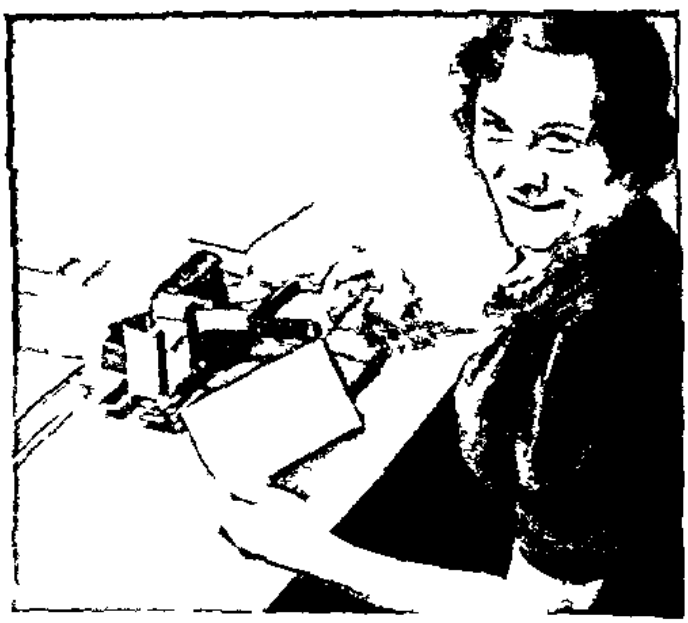


Mule loaded with portable outfit for starting back fires It sprays flaming oil on grass or leaves as illustrated above

A REACTIVE flame thrower to combat destructive mountain and canyon blazes by setting back fires has been perfected by U S Forest Service engineers at Santa Barbara Calif Using Diesel oil as fuel the apparatus may be carried into threatened areas by truck on muleback or on a frame supported by two men A small gasoline engine pumps the fuel through a forty foot line to the nozzle In a recent five hour test, the machine sprayed forty five gallons of oil enough to start a back fire several miles long

Addressing Machine for Home or Club

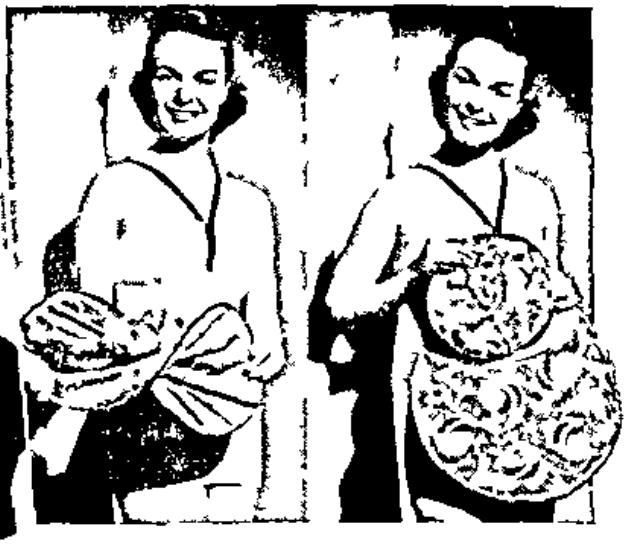
AN INEXPENSIVE new addressing machine serves homes churches clubs and small businesses whose correspondence frequently goes to the same mailing list Stencil cards prepared on a typewriter give as many as 10 000 impressions apiece For use up to sixty five stencils are placed at once in a hopper at the left of the machine The user then places each blank envelope in turn against a guide uses a finger tip shift to flick a stencil into position beneath an inked roller and depresses a printing handle The method is said to produce neatly printed names and addresses at eight times the speed of hand addressing



This device speeds addressing envelopes to mailing lists

Beach Sunbonnet Is Collapsible

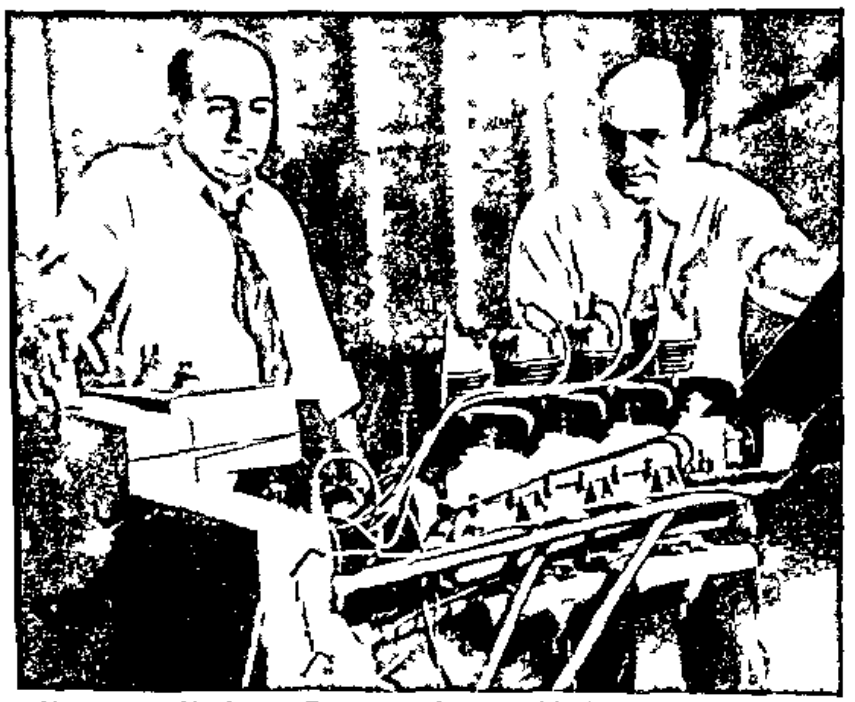




Folding up the beach sunbonnet shown in use at the left It goes into a handy bag

SERVING as a beach umbrella in miniature the new sunbonnet shown at left is collapsible Upper views show how it may be tucked away when not in use by bending the flexible wire rim into a figure 8 folding over the loops and slipping the pancake shaped result into a handbag for beach accessories The linen top that serves as a sunshade is available in a large variety of colorful patterns Despite its wire frame the hat is light in weight

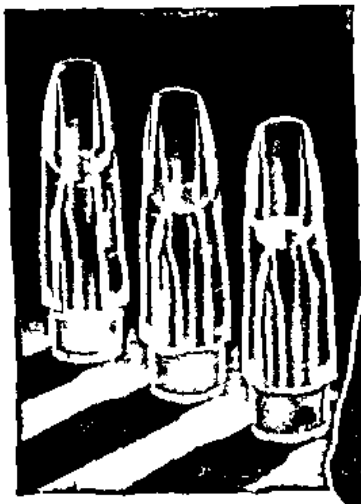
Lightweight Plane Motor Has Few Parts

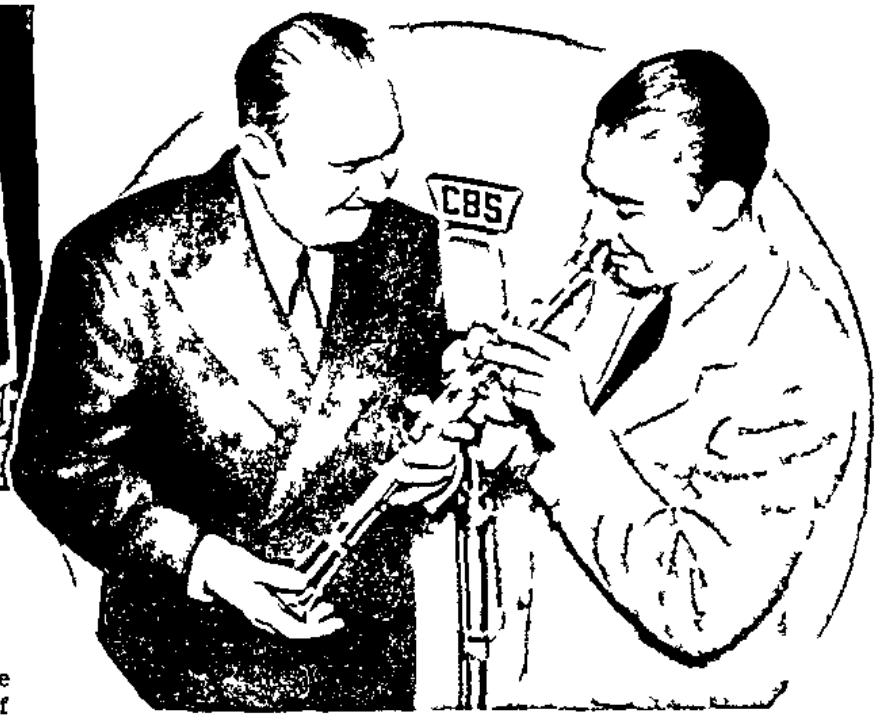


Victor and Charles A Toce with their simplified motor for airplanes

DISPENSING with a carburetor a radical new airplane motor has been designed by Charles A and Victor Toce of Houston Tex Using half as many parts as a standard motor, they claim it will develop twice the horsepower with the same displacement and less weight In addition they call their engine inexpensive to build and well suited to mass production The two brothers have offered it to the U S Government which recently has created a special board of experts to pass judment upon the military usefulness of civilian inventions

Transparent Clarinet and Mouthpieces



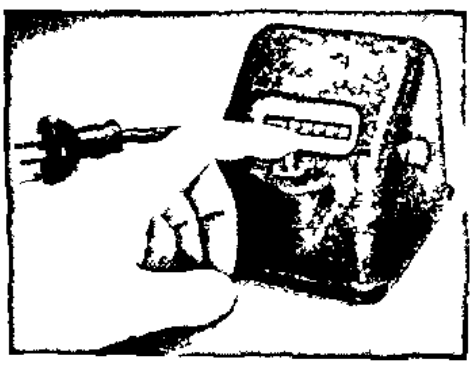


Cla net mouthp eces of t anspa ent plast c R ght Paul Wh teman exam nes an nst ument made of th s mate al

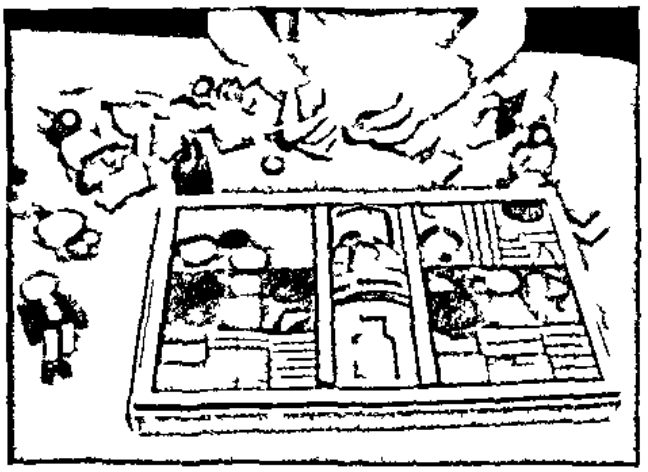
IT S easy to see where the music comes out if you play a clarinet of transparent plastic material like the one be ing examined by Paul Whiteman famous orchestra leader in the photograph above While the entirely transparent clarinet is still something of a novelty mouthpieces of the new material are now available to clarinet ists for use with conventional instruments of wood or metal Light in weight, the trans parent plastic mouthpieces are said to be dur able and proof against warping and splitting

Electric Stop Watch Is Easy To Read

USABLE wherever it can be plugged into a 110 volt A C electric outlet a novel electric stop watch has a counter like the odometer on your car This makes it easy to read time in intervals *as small as one tenth of a second up* to 10 000 seconds or about two hours and forty s x minutes Press ng a but ton sets the timer back to zero



Tme s reco ded on d ect read ng counte



Sponge-Rubber Building Set

FIGURES of birds animals trees trains and other objects can be constructed from novel *blocks made of sponge rubber* Put up in kit form with a supply of rubber cement and a wooden spreader the die cut rubber blocks are designed as an instructive and entertaining toy for children of all ages

Paper Made from Clay





Dr Ernst Hauser exam ning a sam ple of the m neral paper he de veloped Above are mater als from wh ch t s made benton te from Cal forn a (at top) and Wyom ng





In one form als f lm can be used as a w app ng mater al nstead of cellu lose f lm or waxed paper

PAPER from clay a remarkable new product for household industrial and war use has just been developed at the Massachusetts Institute of Technology While various kinds of it may be applied in familiar ways—as in transparent wrap ping sheets and milk containers—the min eral paper is far more than a substitute for wood pulp or linen paper

In printing its ultrafine texture imparts new clarity and detail to half tone illustra tions Waterproof and nonabsorbent it gives a much higher gloss than common paper Unaffected by age it may be em ployed for permanent records

Its fibers can be made into filter cloth

Other uses m lk conta ne s threads ac dproof f lter cloth and molded parts for motors

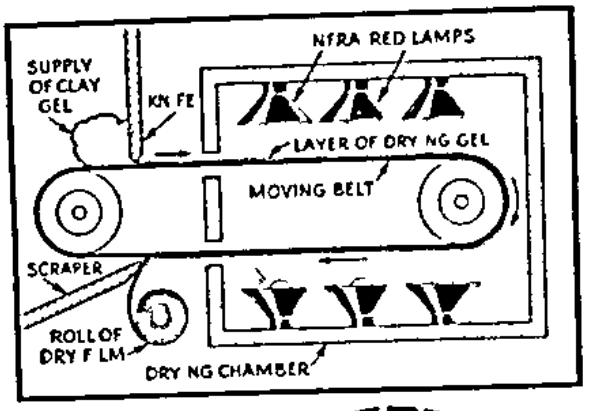


invaluable to chemical industries because of its resistance to corrosive acids and al kalies A flexible sheet form can be wrapped around electric cables for insulation

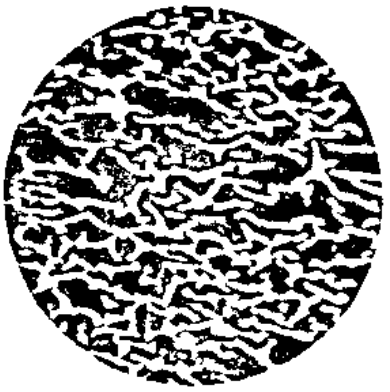
For mica a strategic war material used in electrical parts of autos planes and radios the United States depends almost ent rely on imports from abroad Since the new clay paper has the same chemical com position and electrical insulating qualities stiff sheets of it should make an admirable substitute

Called alsifilm the new paper takes its name from the first letters of aluminum and silica These are the constituents of Wyo ming bentonite a type of clay that serves as raw material for light brown mineral pa per Another kind of bentonite from Cal ifornia yields white paper

Ground to fine powder the clay is sus pended in water while grit and foreign mat ter settle out Evaporated to a jellylike mass the res due then is chemically treated accord ng to the desired use Ultramicro scopic mineral fibers mat together during the process as fibers of ordinary paper do



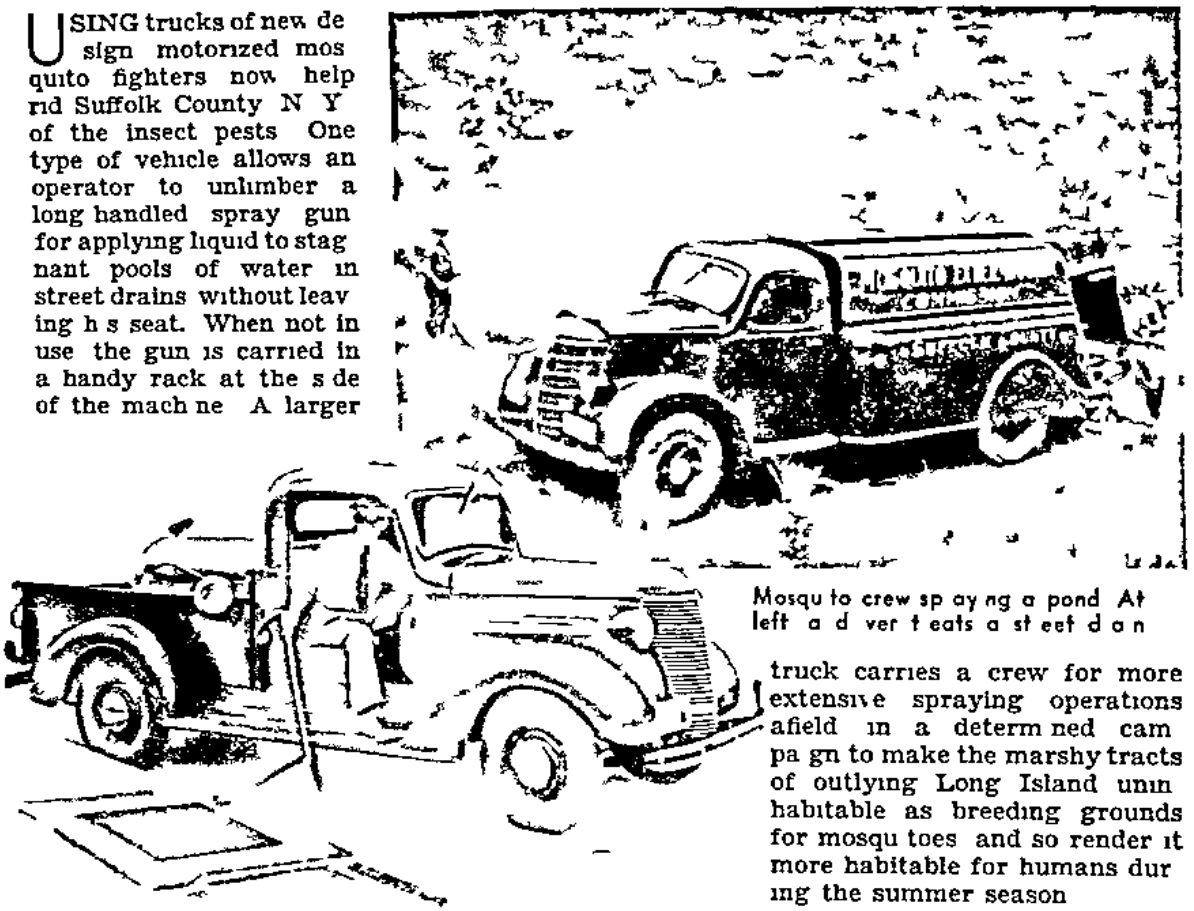
PAPER FROM COMMON CLAY



Howap epa ed clay s tu ned nto pape The v ew at r ght shows the mat ted m croscop c m neral f bers

Trucks Aid War on Mosquitoes

USING trucks of new de sign motorized mos quito fighters now help rid Suffolk County N Y of the insect pests One type of vehicle allows an operator to unlimber a long handled spray gun for applying liquid to stag nant pools of water in street drains without leav ing h s seat. When not in use the gun is carried in a handy rack at the s de of the mach ne A larger truck carries a crew for more extensive spraying operations afield in a determ ned cam pa gn to make the marshy tracts of outlying Long Island unin habitable as breeding grounds for mosqu toes and so render it more habitable for humans dur ing the summer season



Mosqu to crew sp ay ng a pond At left a d ver t eats a st eet d a n



Workers remov ng r vets from dry ice boxes for immed ate use n planes

Refrigerators Keep Airplane Rivets Fresh

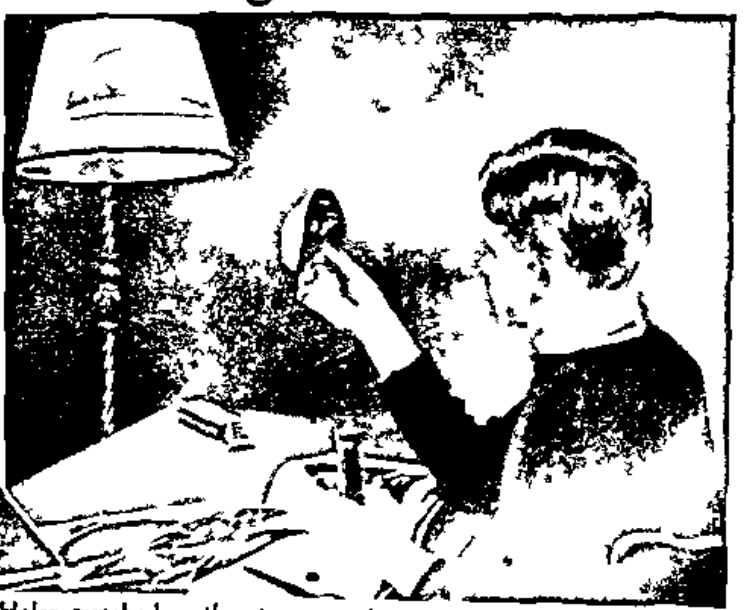
RIVETS for use in build ing giant four engine bombing planes seventy four passenger Clipper ships and thirty three passenger high altitude transport planes are stored in special refriger ator cabinets in a Seattle Wash. airplane factory Made of aluminum alloy the rivets are first sub jected to a heat treat ment in a special unit built for the purpose and then transferred to stor age chambers maintained at a low temperature by solidified carbon dioxide or dry ice The cold treatment is said to re tard the aging or harden ing of the rivets and thus keeps them indefinitely in the proper condition for driving Rivets are taken from the cold chambers only as needed and are driven into place within fifteen minutes

Star Charts Make Midget Planetarium

WITH scissors glue and a needle or ice pick amateur as tronomers can transform flat printed charts of the heavens in a novel book just published in to rounded domes that serve as a miniature planetarium When a dome is held against a light holes punched as marked on it show the positions of the stars



A chart torn f om the book forms a dome



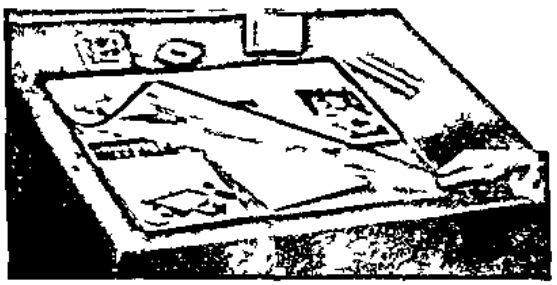
Holes punched n the star map show pos t ons of constellat ons and stars when the dome s held up between the user and a l ght

Toy Balloons Help Opera Singer Get More Lung Power

DEVELOPING the lung power required to throw an aria into the back rows of the top gallery is a problem that Hilda Burke New York opera singer solves by the curious expedient of blowing up toy ballons As part of her practice sessions supplementing lessons in voice training Miss Burke inflates half a dozen or more balloons every day Balloon blowing she believes not only does a great deal to strengthen her lungs, but also tends to enrich her vocal tones At the right, she is seen engaged in the novel exercise



Hilda Burke giving her lungs a work out by blowing up balloons



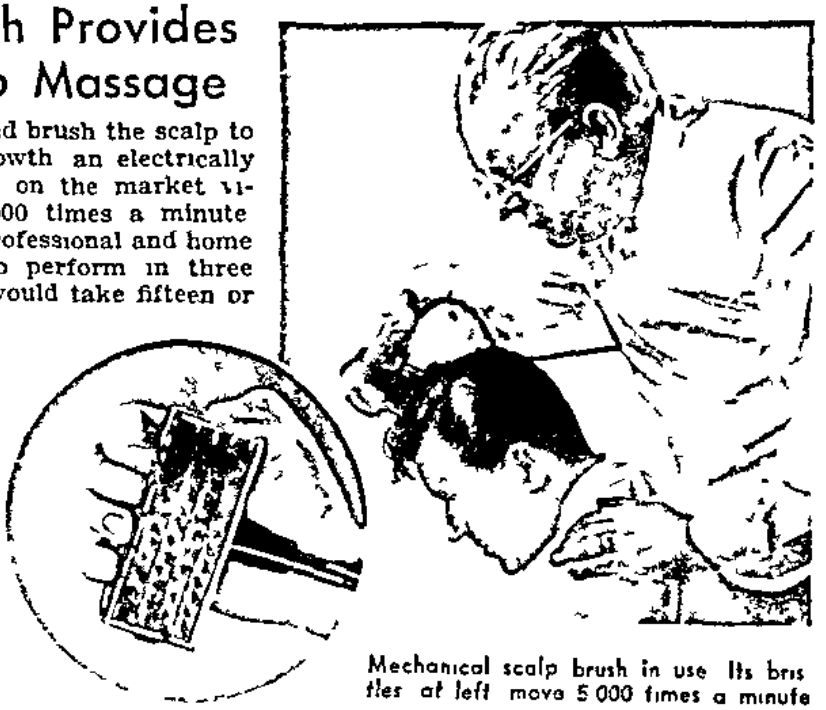
Memorandums put under the flap are always visible

Transparent Writing Flap Tops Off New Desk Cover

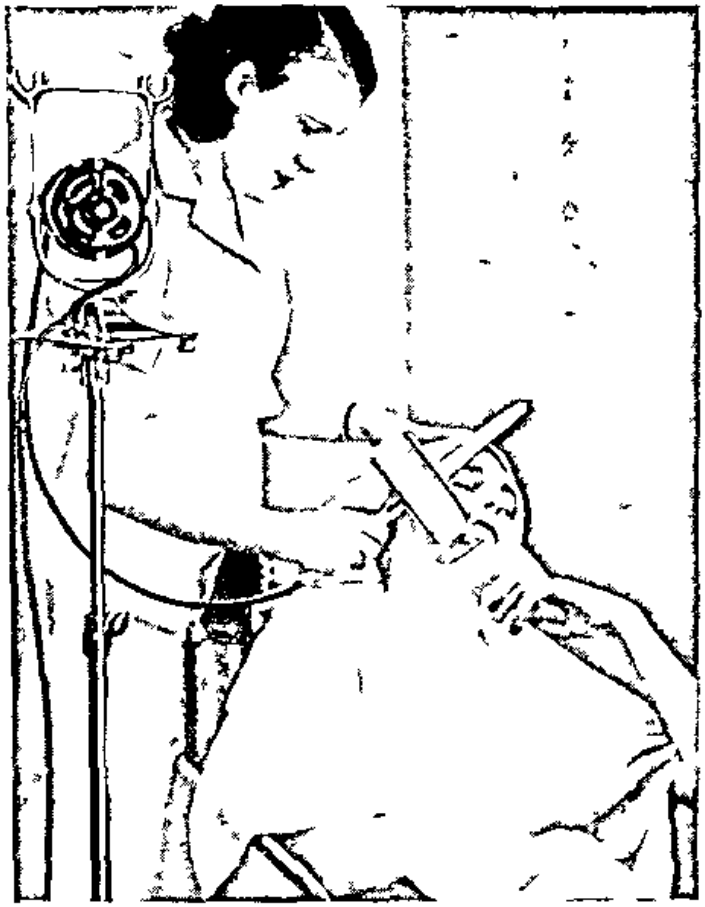
MADE in two sizes for office or home use, a new desk cover is equipped with a top flap made of fireproof transparent material that provides a smooth writing surface Being hinged, the flap may be raised to permit use of the blotter beneath Calendars, memorandums, and other reference material can be placed underneath the flap

Vibrating Brush Provides Efficient Scalp Massage

DESIGNED to massage and brush the scalp to stimulate natural hair growth an electrically powered scalp brush now on the market vibrates at the rate of 5 000 times a minute Made in models for both professional and home use the brush is said to perform in three minutes a brushing that would take fifteen or twenty minutes if done by hand The brushes are driven by means of a flexible shaft connecting the brush head with an electric motor Opening two clamps on the side of the brush head allows the user to remove the brush for cleaning and sterilization Monthly oiling is the only maintenance the outfit requires



Mechanical scalp brush in use Its bristles at left move 5 000 times a minute



New massage device in use Paper paddles slap the skin gently

Paddles Provide Cool Massage

WHIRLED by a flexible drive shaft connected to an electric motor, paper paddles in a new beauty device massage the skin According to the inventor, the paddles create a circulation of air around the area being massaged thus overcoming the objection of heat created by the massaging action The device is intended for use by operators in beauty parlors and barber shops

Standard Musical Pitch Broadcast

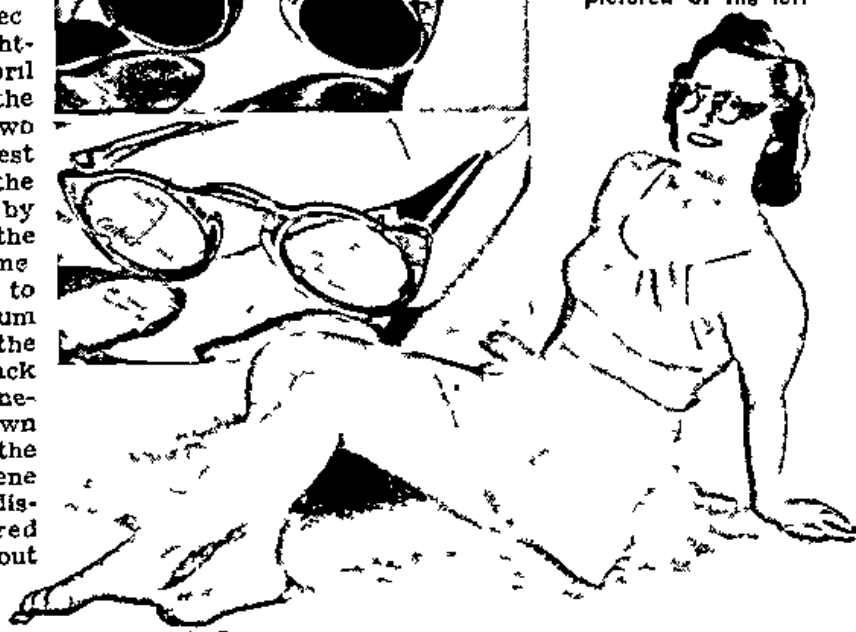
MUSICIANS who wish to check the tuning of their instruments can now do so by tuning in on WWV, the radio station of the National Bureau of Standards at Beltsville, Md The standard for musical pitch, 440 cycles a second for A above middle C, is broadcast twenty-four hours a day, except when other Bureau programs are on the air

Adjustable Sun Glasses Regulate Light

SUN GLASSES recently introduced can be adjusted by the wearer to admit more or less light, according to the brightness of the sun and its reflected glare The sun spectacles utilize special light-polarizing glass (P S M, April 36 p 20) Each eye of the wearer looks out through two special lenses The lens nearest the eye is stationary, while the front lens can be rotated by pushing a small button on the bridge of the spectacle frame When the button is moved to the extreme left the maximum amount of light reaches the eyes, but as it is pushed back toward the right, light penetrating the lenses is cut down until they are so dark that the brightest possible beach scene may be viewed without discomfort Special louvered plastic side shields block out annoying reflections



By rotating the outer lenses of these sun glasses a user can admit any amount of light desired as pictured at the left

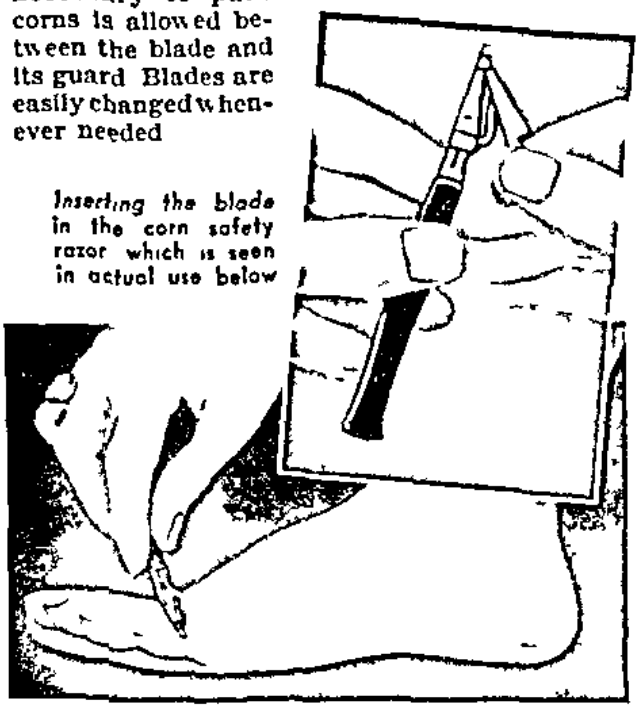




Safety Razor for the Feet Trims Corns and Calluses

CORNS and calluses may easily be trimmed with complete safety, it is claimed, by a new type of corn safety razor Made with a molded plastic handle, the tool is equipped with a surgical-steel blade shaped to fit a metal guard in such a way that only the exact shaving space necessary to pare corns is allowed between the blade and its guard Blades are easily changed whenever needed

Inserting the blade in the corn safety razor which is seen in actual use below



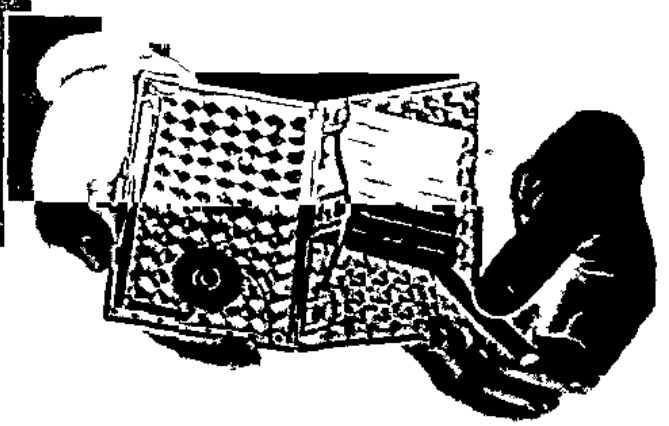
Gold Plating on Glass Makes Novel Jewelry

GLASS BEADS plated with gold or other metals are now available The necklace pictured above is made of glass tubing, chopped into beads strung and plated by dipping into a special solution It is said that the plated beads will not tarnish or leave marks on the skin

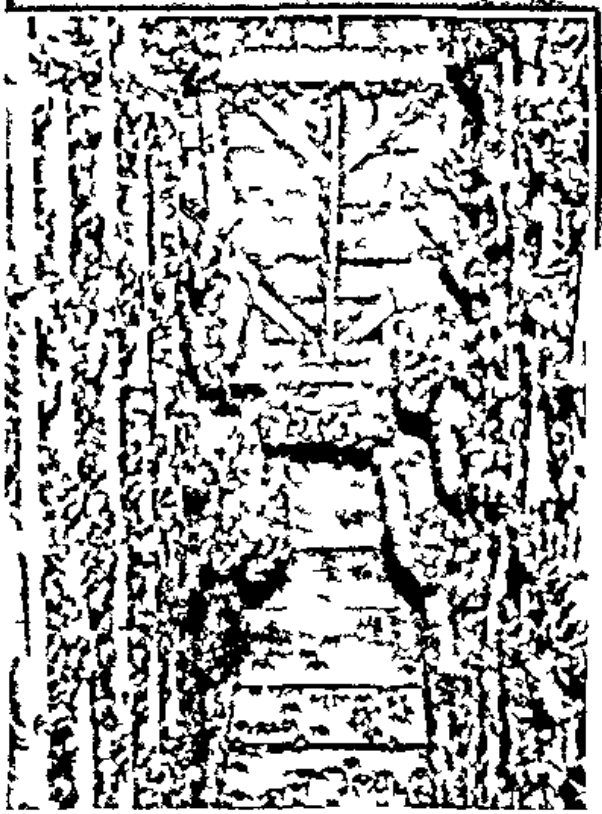


Cigarette Case Keeps Account of Smokes Given to Friends

A NOVEL *cigarette case keeps* tabs on the cigarettes your friends 'borrow' When you want a smoke yourself, press one button to open the case But when an acquaintance 'bums a cigarette press a second button This not only opens the case but operates a counter built into the case



When somebody cadges a smoke, press a special button to open the case A *counter registers the gift*, keeping track of those given away



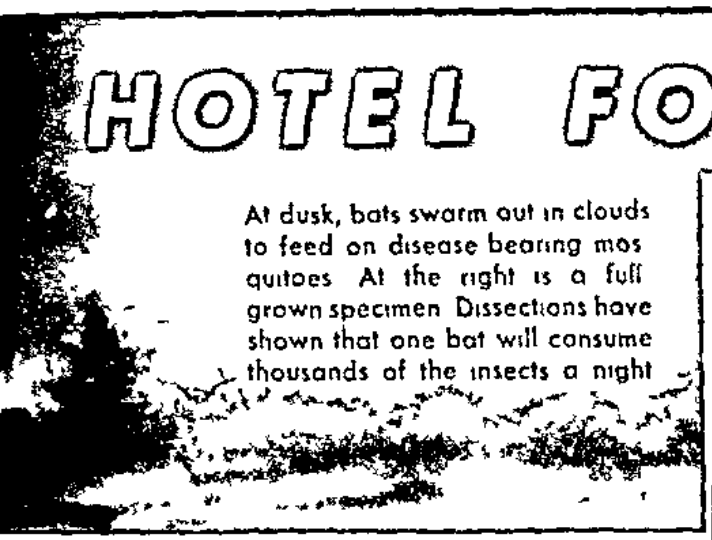
Thousands of bats in the roost maintained by Milton F Campbell of San Antonio Tex., seen at right preparing to harvest guano

PLAYING host to 250 000 bats is the queer but profitable hobby of Milton F Campbell of San Antonio Tex His lakeside bat hotel a tall wooden tower shaped like the base of a windmill is the outgrowth of experiments begun years ago by his father Dr Charles A R. Campbell at that time city bacteriologist of San Antonio Believing that bats would rid the area of malaria carrying mosquitoes Dr Campbell spent years trying to induce the creatures to settle in a wooden roost which he constructed near the city sewage plant. Finally by means of ear splitting phonograph records which drove the bats from their accustomed haunts he effected their transfer to his specially constructed tower

Soon afterwards residents of the region began to notice a decrease in the number of mosquitoes A single bat Dr Campbell discovered by dissection studies will consume as many as 3 750 of these pests during a



HOTEL FOR BATS



At dusk, bats swarm out in clouds to feed on disease bearing mosquitoes At the right is a full grown specimen Dissections have shown that one bat will consume thousands of the insects a night



single night s feeding Since its introduction, the Campbell bat roost has been a source of revenue as well as a laboratory for the study of the strange little creatures it houses Visiting bats tens of thousands of them that choke the interior and often hang in great bunches from the outside eaves pay their rent by adding to the accumulation of guano in the roost

Once a year, Campbell cleans this deposit from the interior, raking it down a chute at the bottom and sacking it up for sale Bat guano is said to be a nearly perfect fertilizer Sampled and labeled, as required by law it sells for from five to ten cents a pound Last year, the roost yielded nearly 6 000 pounds of guano In fact, so profitable has the unique venture become that quantities of the special lure used for attracting bats and detailed plans for establishing similar roosts, have been sold to prospective bat raisers in several parts of the country, with an eye to both profit and mosquito control



Karl Busch with some of the products of his novel pastime

Artist Makes Faces of Avocado Seeds as Lapel Ornaments

PROBABLY the only avocado-seed carver in the world is Karl Busch, a Hollywod movie studio artist whose hobby is turning the seeds into odd little faces to be used as lapel ornaments Already, Busch has produced more than seventy-five of the oddities Originally, the seeds are soft and easily worked After the carving is completed, Busch places them in the sun for curing When they are almost as hard as ivory, he paints them with bright-hued water colors and applies five coats of lacquer which give a high gloss and preserve the material almost indefinitely against rot

Tiny Museum Holds 25,000 Rare Items



Frank S Van Den Bergh shows a skull of a prehistoric Indian unearthed near his Santa Barbara Calif home

FORTY years ago Frank S Van Den Bergh a retired estate superintendent of Santa Barbara Calif sent a shell he had picked up to a physician in Japan In return he received a shell from the Orient That was the beginning of a remarkable one room museum holding 25 000 specimens most of them acquired by trading

Excepting for short trips Van Den Bergh has never traveled in quest of specimens By correspondence he has assembled from eleven different countries the 15 000 shells and the 10 000 miscellaneous items which cover the walls and ceiling of his twelve by twenty foot museum



Besides 7 000 arrowheads he has ancient skulls from the Southwest and a rare Indian boomerang used by an early American hunter centuries before the coming of the white man One unusual contribution from the Orient is a miniature reproduction of India s famous temple Taj Mahal It arrived smashed and had to be carefully repaired

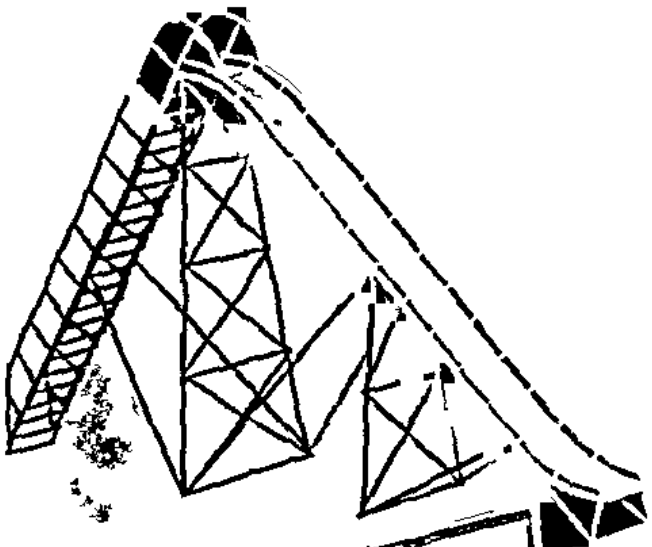
Among the vast collection of shells in his Tom Thumb museum Van Den Bergh has specimens hardly larger than sand grains and others so big they once housed Australian clams that weighed 100 pounds How much his complete collection is worth he can only guess One shell alone a rare Voluta from Florida would bring $200 Recently Van Den Bergh parted with seven shells for twenty five dollars—the first cash sale he has made since starting his museum

By trading with other collectors in two hemispheres the hobbyist turned this small room into a private museum with 25 000 rare items

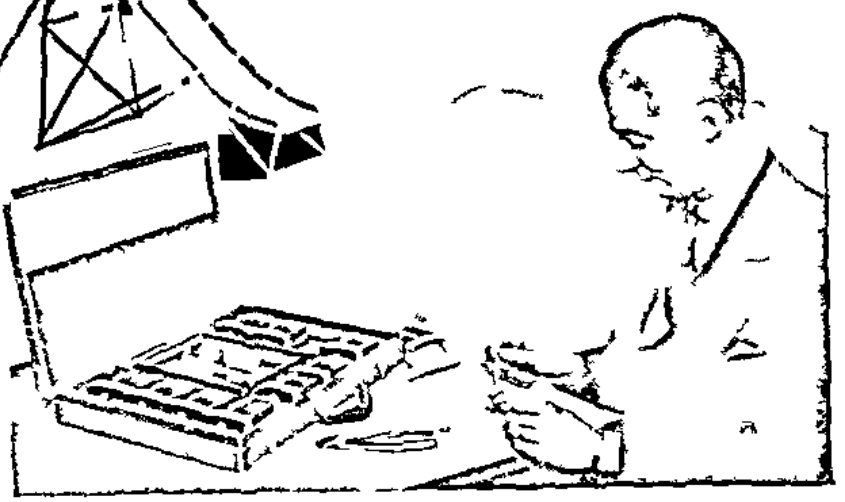
POPULAR SCIENCE

Toothpick Engineers Get Building Kit

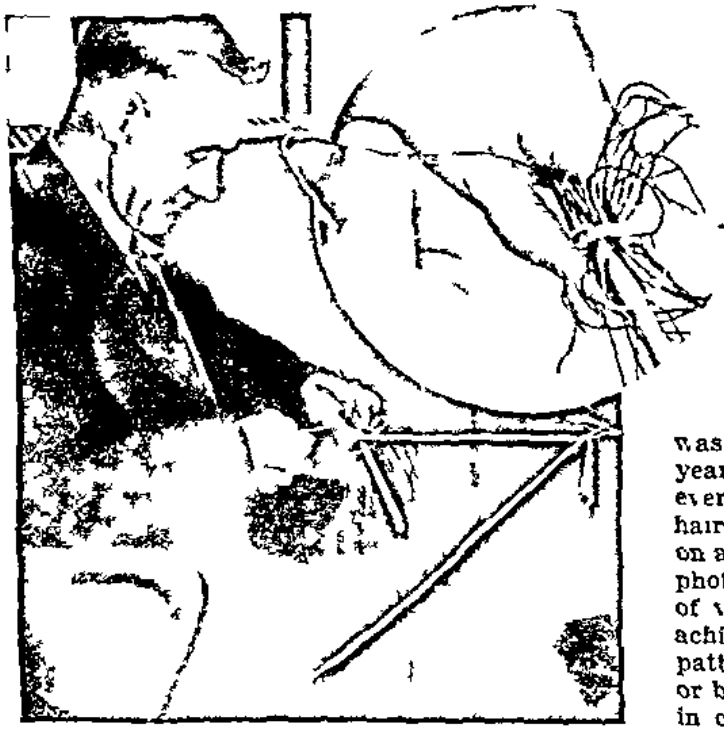
FOR those interested in the hobby of constructing models with toothpicks and glue (PSM Feb 40 p 70) a New York manufacturer has just introduced a special kit In addition to a supply of toothpicks and cement the kit has a pair of cutting pliers and a pair of small tweezers The outfit made in two sizes is packed in an attractive box that is fitted with leather handles and metal locks to resemble a suitcase



This model playground slide was built with tools and materials contained in the kit



As illustrated at the right the outfit comes packed in a handy case with a carrying handle



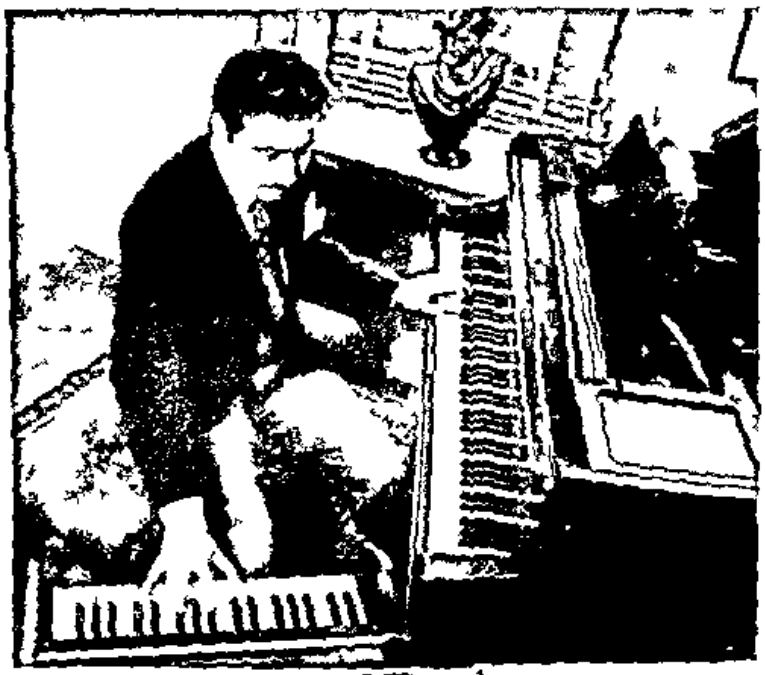
Eugene Barnett engaged in his unusual hobby The horse hair is woven on a round dowel rod as shown in circle

Hobbyist Revives Old Indian Art of Weaving Horsehair

MAKING belts bridles harness whips and other articles of horsehair is the unusual hobby that Eugene Barnett of Grangeville Idaho has turned into a paying business The art of weaving horsehair once practiced by the Indians was revived by Barnett some thirty years ago and he has been doing it ever since Black horsehair as well as hair dyed in various colors is woven on a round dowel rod as shown in the photographs at the left Horsehairs of various colors make it possible to achieve interesting and decorative patterns in the finished work A belt or bridle woven on the rod comes off in circular shape when finished and is then pressed out flat Barnett gets unusually high prices for his work

Composer Collects Music Boxes

COLLECTING old and rare music boxes is the interesting hobby of Paul Taubman New York pianist and composer His col l ction rated among the finest privately owned in the world includes such rare items as the music box that combines a harmonium and a bird organ an instrument that emits bird trills and was once used to teach canary birds to sing Another is a master piece of ingenuity Driven by a spring motor it plays eight different tunes and can be set to repeat any selection or play the tunes in any desired sequence The instrument also boasts a volume adjuster bass and treble tone control and a speed regulator Taubman picked it up for twenty five dollars and values it now at nearly $10 000 Interest in these musical machines which often combine several instruments in one led Taubman to master the art of playing a piano and an organ at the same time as pictured at the left

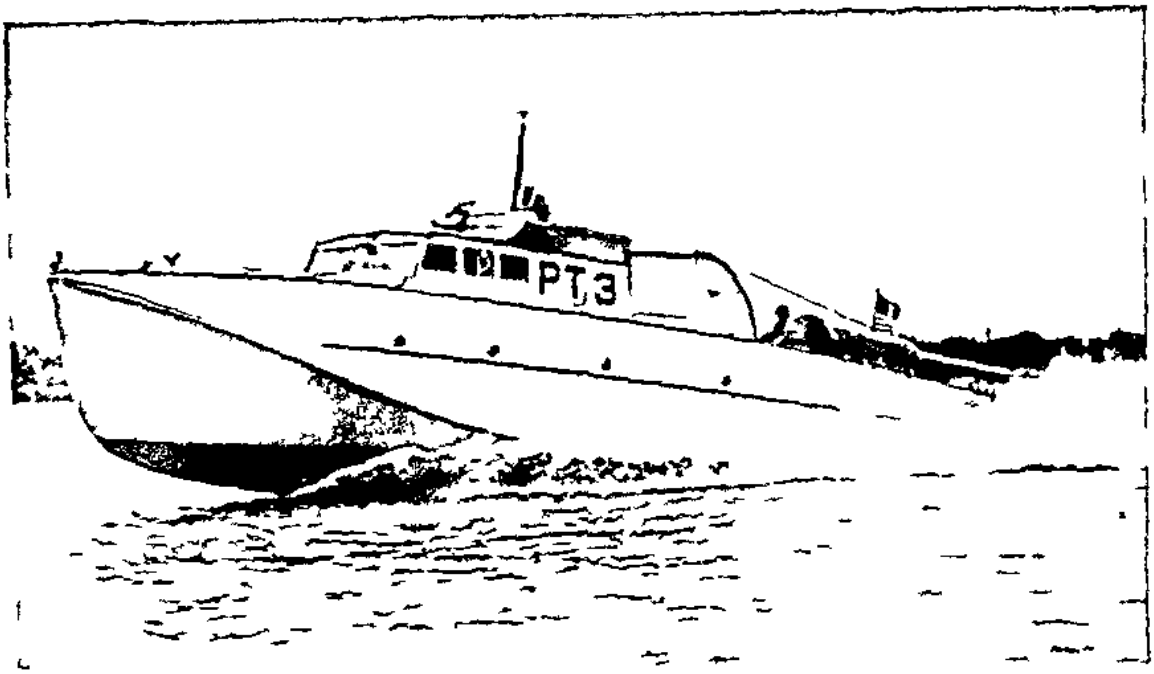




Mus c boxes led Paul Taubman to learn to play p ano and organ s multaneously

Th s ingen ous Sw ss mach ne plays e ght d fferent tunes n any order des red The hobby st s seen at the r ght with part of h s collect on He holds in h s hands a mus cal jewel box

Fast Patrol Boat Mounts Heavy Armament

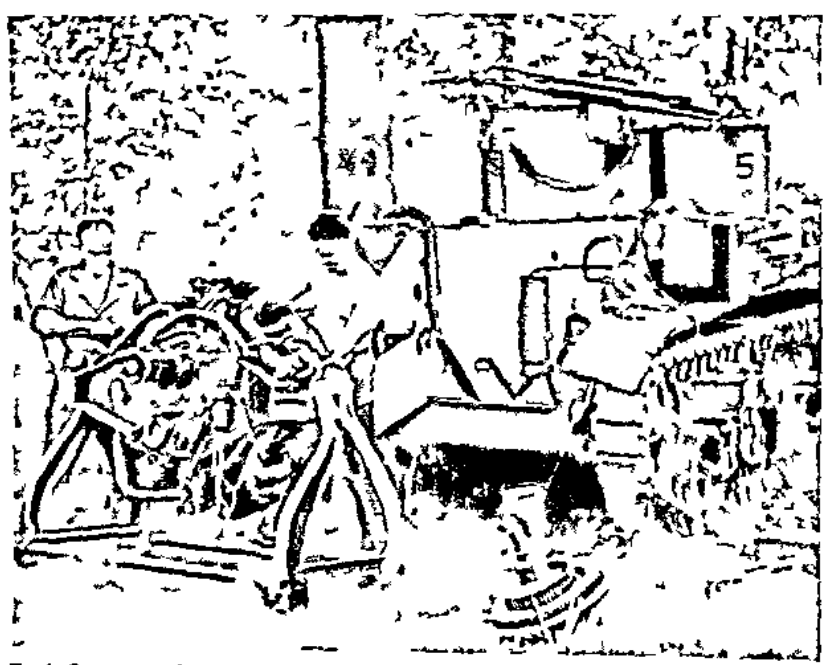


One of Uncle Sam s exper mental mosqu to fleet des gned to guard mportant coastal waters in wart me

SMALLEST of the U S Navy s fighting craft the fifty nine foot coastal motor boat *PT3* carries formidable armament into action at racing speed With thirty similar boats ranging up to eighty one foot length built or building it will form an experi mental mosquito fleet armed with torpedoes depth charges machine guns and smoke screen generators The boats can be turned out rapidly by mass production A potent threat to submarines and surface warships alike they are intended mainly for patrol ling such waters as Chesapeake Bay Puget Sound and the mouth of the Mississippi River By taking over these duties they would release destroyers for operations far at sea The name *PT3* is the Navy s desig nation for patrol torpedo boat No 3

Tank Engines Are Repaired in the Field

ENGINES of radial design like those of airplanes propel mili tary tanks of the U S Army Quickly de mountable for repairs the motors are easy to overhaul in the field as shown at the right. The scene took place at recent ma neuvers of the U S Army Tank Corps in Louisiana Shortly after the picture was made the speedy mechanized unit was rolling on its way



Tank Corps mechanics overhaul ng a rad al motor n recent Army maneuvers

Can We Defend Our Coasts?

By
ARTHUR

twelve nch mortar
ts fly at a target



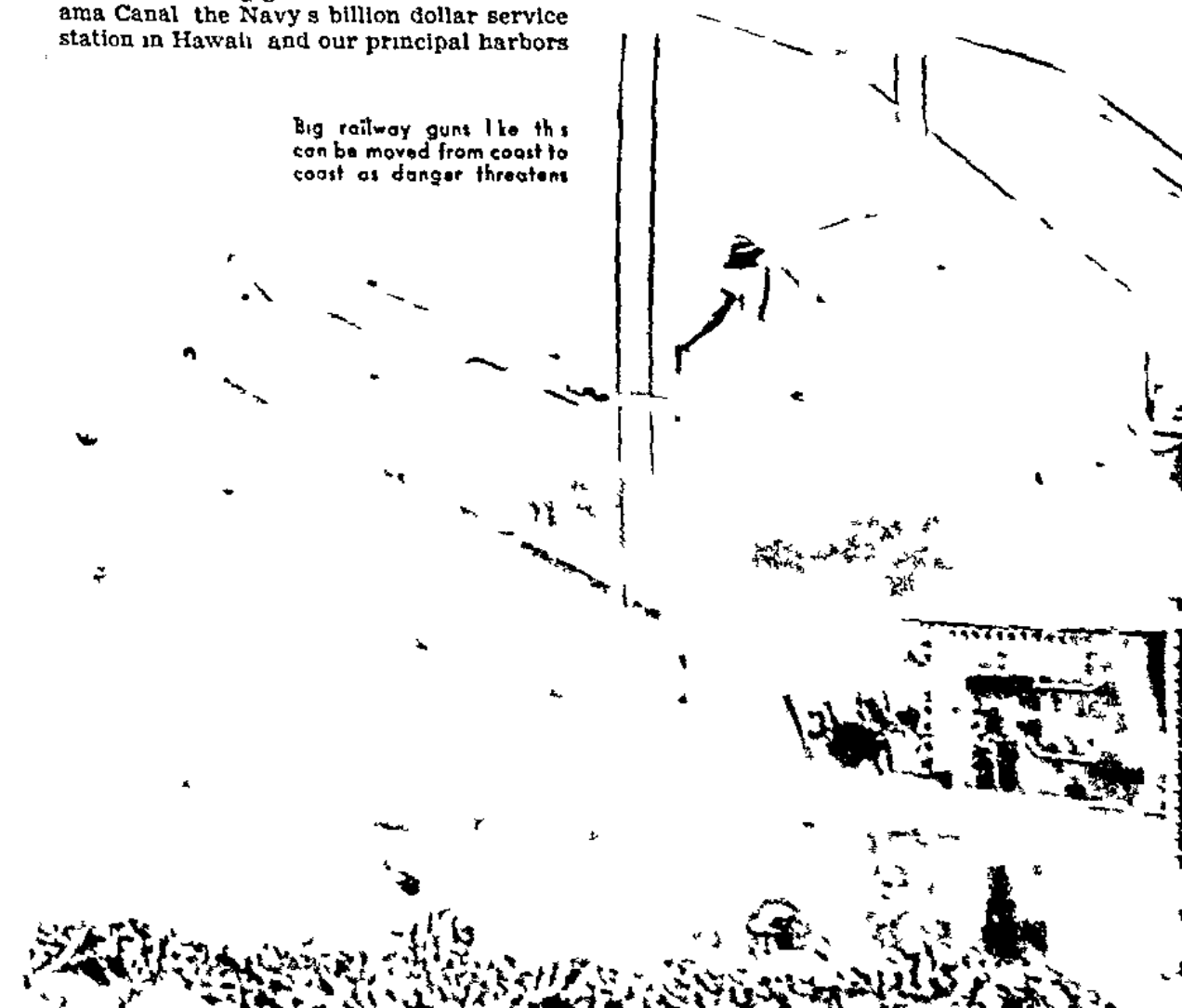
A GLIMPSE OF A LITTLE-KNOWN BUT VITAL LINK IN NATIONAL DEFENSE—THE COAST ARTILLERY

MOST people think of the Navy as our first line of defense In one way it is and in another way it isn t. Its major war job would take it on an offensive mission—to head off and defeat an approaching enemy fleet far from our home shores Stringing out the big-gunned ships for close in defense of our long ocean frontier would make their offensive use impossible, would abandon the seas to the adversary, and would surrender our overseas possessions and our maritime routes for obtaining vital war supplies Our widely scattered warships would be push-overs for a concentrated hostile fleet Therefore our ships of the line must be kept together, regardless even of the off chance that fleets in the Atlantic and Pacific might attack us simultaneously

So if the word defense is used in its narrower, close to home sense the U S Navy isn t a defensive weapon at all Our first line of defense becomes the Army s Coast Artillery Corps Its seldom written-about soldiers man the big guns that defend the Panama Canal the Navy s billion dollar service station in Hawaii and our principal harbors and seaport cities located on the mainland

There aren t and there never will be, enough guns in America to cover all our many thousands of miles of seacoast Fortunately, that sort of defense isn t necessary To have any real chance of success a modern invading army must control well-equipped ports of disembarkation Soldiers sometimes can be landed on an open beach, but it is next door to impossible to land tanks large caliber field guns and all the other heavy material which is essential to present day mechanized warfare without adequate facilities So the chief wartime responsibility of the Coast Artillery would be the protection of the United States against invasion by keeping our important seaports safe against capture

Other of its numerous duties would be guarding our thickly populated coast cities against bombardment by enemy warships protecting the Navy s bases and defending the fortified strong points in our system of seacoast defense which would allow our

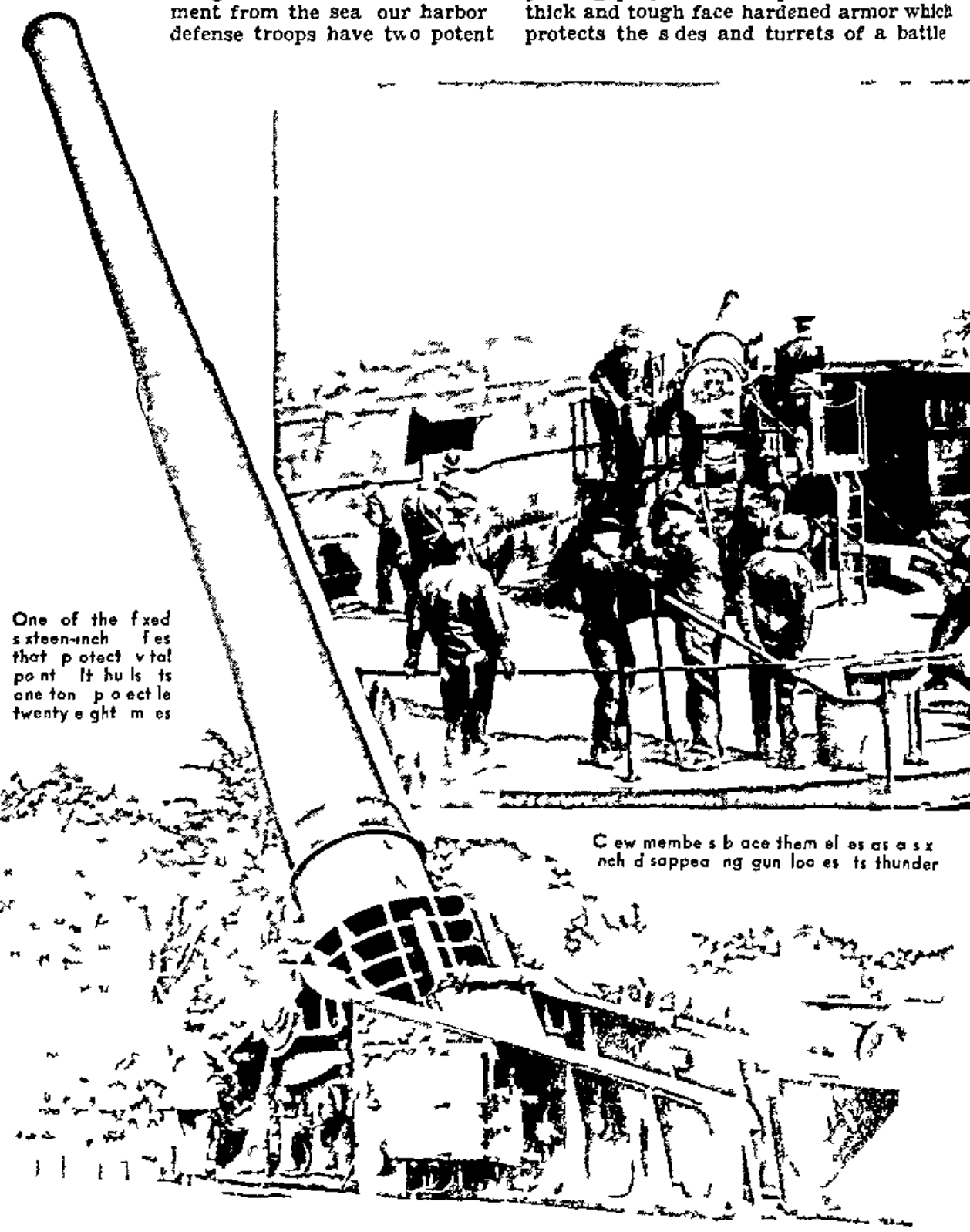


Big railway guns like this can be moved from coast to coast as danger threatens

mobile ground Army and Air Force to re main concentrated for qu ck action aga nst an invader who took the long chance of land ing on some unprotected beach To both the Navy and the Army the harbor defense ar t llery is as invaluable as a good goalie is to a hockey team and for the same reason—by playing Kitty bar the gate it gives the rest of the team freedom to at tack

To do their work of protecting us against invasion or bombard ment from the sea our harbor defense troops have two potent weapons—big guns and submarine mines.

The king pins of their armament are the mighty sixteen inch guns—as large seacoast guns as there are in the world except for a few eighteen inchers which the Brit sh have mounted in their Singapore defenses. They have an extreme range of twenty eight miles—the range of a sixteen inch gun mounted in a battleship turret is about twenty miles—and at somewhat shorter ranges their one ton n ckel chrome armor p ercing projectiles will perforate even the thick and tough face hardened armor which protects the s des and turrets of a battle



One of the f xed s xteen-inch f es that p otect v tal po nt It hu ls ts one ton p o ect le twenty e ght m es

C ew membe s b ace them el es as a s x nch d sappea ng gun loo es ts thunder

ship, and burst in the ship s vitals with effects likely to be deadly Operated by electrical machinery, they can be fired for indefinite periods at an astoundingly high rate of speed. It is these mighty weapons which are most depended on to keep any hostile fleet well out of range of the vitally important locks of the Panama Canal, the naval base at Pearl Harbor in Hawaii, and cities such as New York and San Francisco

Disappearing guns, in which the recoil throws the gun back to loading position behind a parapet and counterweights bring it back into firing position, aren t being built these days because the design of their carriages makes it impossible to give them sufficient elevation for long-range fire But we have a good many of them in our coast defenses, and their 1,560-pound projectiles have what it takes to sink a battleship — if the battleship obligingly comes within their range of ten miles Another of our coast-defense weapons whose game is the capital ship is the twelve-inch gun, with a range of seventeen miles The high angle plunging fire of the twelve-inch mortars mounted in many of our coast defenses is dangerous against the deck armor of any ship which ventures within their eight-mile range Batteries of ten-inch and six-inch guns, which have ranges of about eight miles, are for use against cruisers, destroyers, transports, and other non-capital ships A hit in a vital spot by a six-inch gun will put a destroyer out of action Three-inch rapid-fire guns, which have a range of six miles, are used to protect mine fields

All our fixed seacoast guns are mounted in harbor defenses, but not all of them are protected by concrete parapets or bombproof emplacements Against the growing menace of the bombing airplane, concealment is considered even more important than protection, and some of our newest big guns are mounted in the open and depend on clever camouflage for comparative safety Antiaircraft guns, both fixed and mobile, are provided for the protection of the big guns and the men who fight them from attack from the air

Railway artillery is equally valuable for supporting fixed guns in the defense of fortified positions and for use against an invader attempting a landing at a place not protected by permanent coast defense but within a reasonable distance of a railroad line Fourteen-inch railway guns have a range of twenty-four miles their job is to attack an invader's battleships and big cruisers. Eight-inch railway guns have a range of thirteen miles and are for use against lighter warships and transports Railway artillery has the important advantage of what the soldiers call 'strategical mobility"—although it can t be moved very fast, it *can* be moved from one coast to the other

Regiments of 155-millimeter tractor-drawn guns—the same type of heavy gun that is used by our Field Artillery—also are part of our coast defense system They are capable of fairly high road speeds, and they do not require previously prepared positions. Their range is about ten miles

Both railway and tractor guns are highly important weapons in the defense systems of the Panama Canal and Hawaii

Much less spectacular than the Coast Artillery's big guns, but every bit as important for the defense of our harbors, are its fields of submarine mines Mine fields are carefully planned in peacetime, the mines and *(Continued on page 218)*

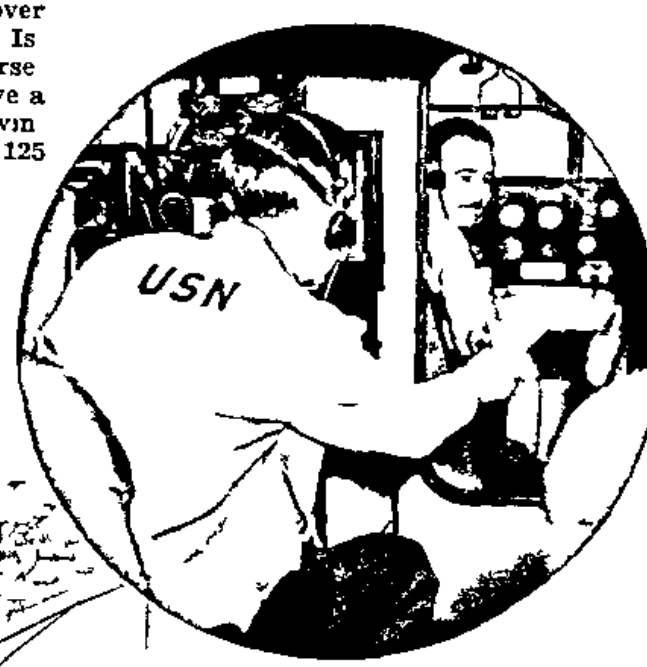




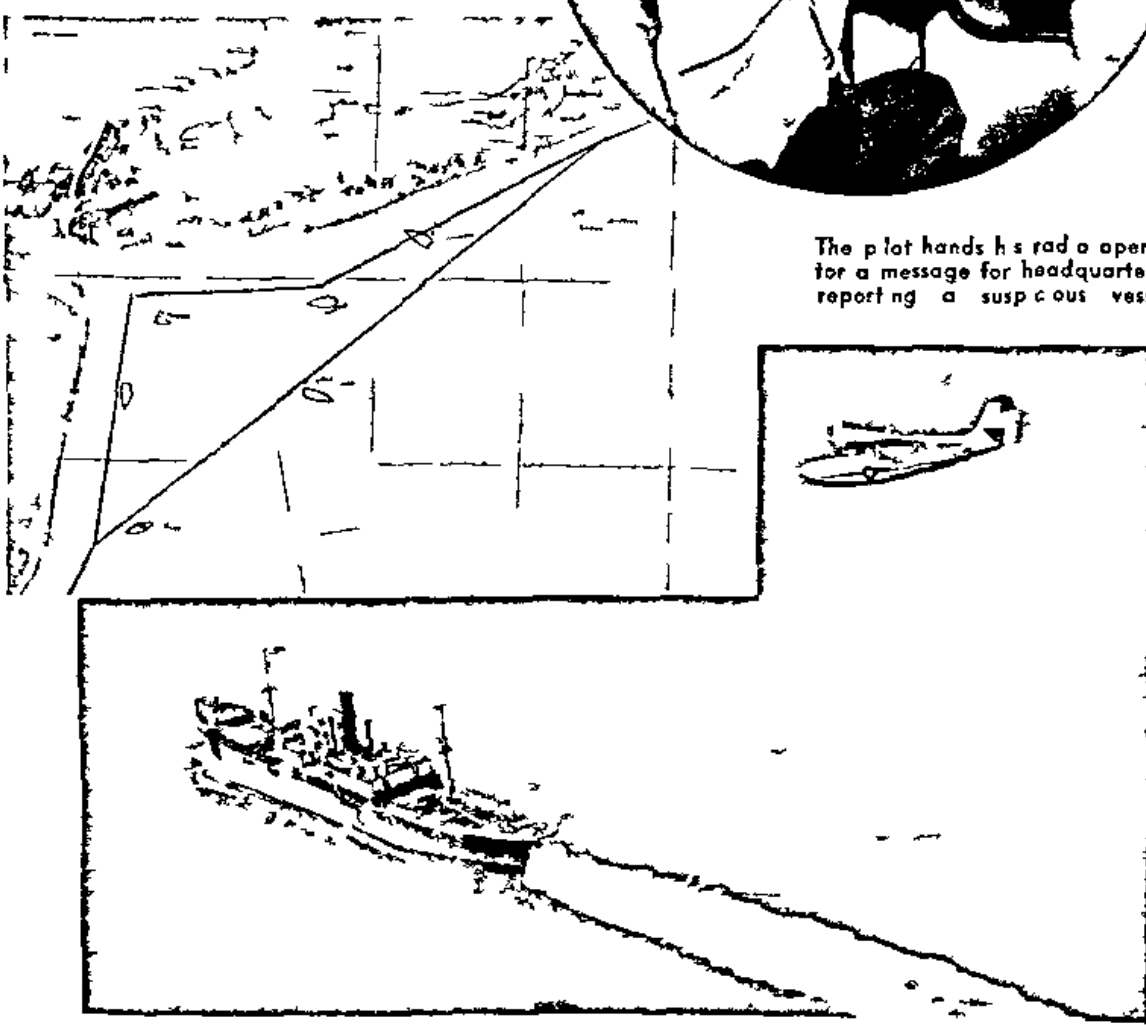
The men behind the guns Coast Artillerymen loading a railway mortar at target practice

Coast Guard Patrols Sea Lanes

TO KEEP an eye on all vessels approaching our northeastern coast two mile a minute flying boats from the U S Coast Guard station at Floyd Bennett Field New York City are combing the sea lanes in swift patrols The flights carry them over an ocean beat that extends from Rhode Island to Maryland Taking off in 1 700 horse power Hall biplane flying boats that have a range of well over 1 000 miles or in twin motored Grumman ships that cruise at 125 miles an hour the pilots and observers often head far out from shore When ever a vessel is sighted the winged ship swoops down and circles until identification is complete Should there be any thing suspicious about the craft a report is flashed by radio to shore headquarters From other Coast Guard bases on the Eastern seaboard and on the Gulf of Mexico similar patrols are also being carried on At present more than thirty long range Coast Guard flying boats like that shown in the illustrations on this page are engaged in the work.

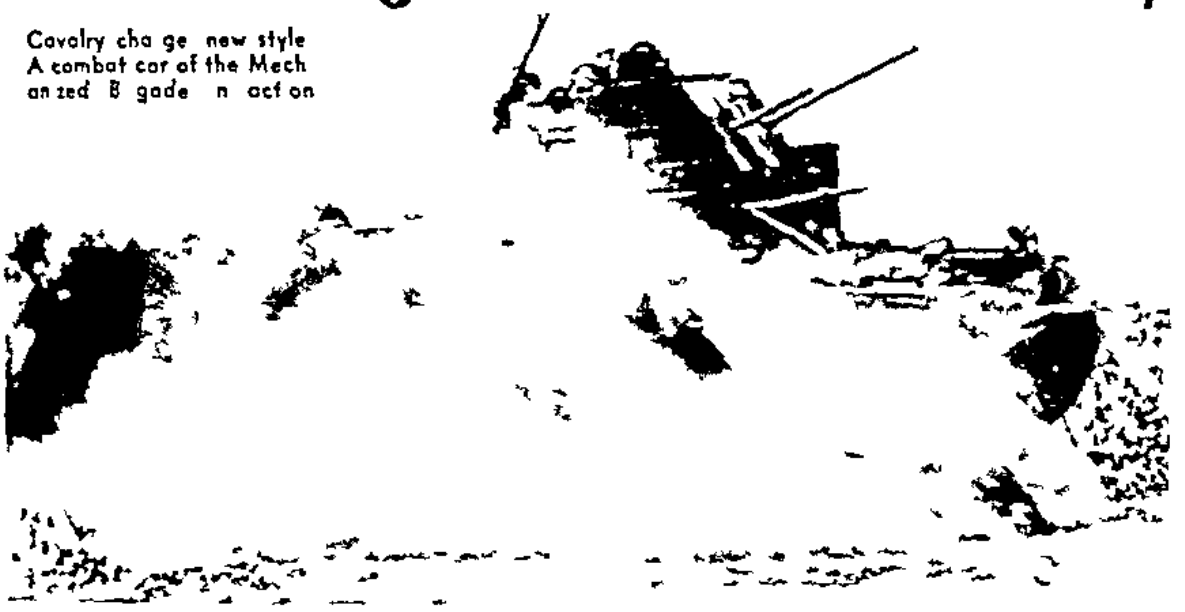


The pilot hands his radio operator a message for headquarters reporting a suspicious vessel



Flying boat circling a ship for identification Map is a report showing vessels sighted on patrol

Grooming the Iron Cavalry



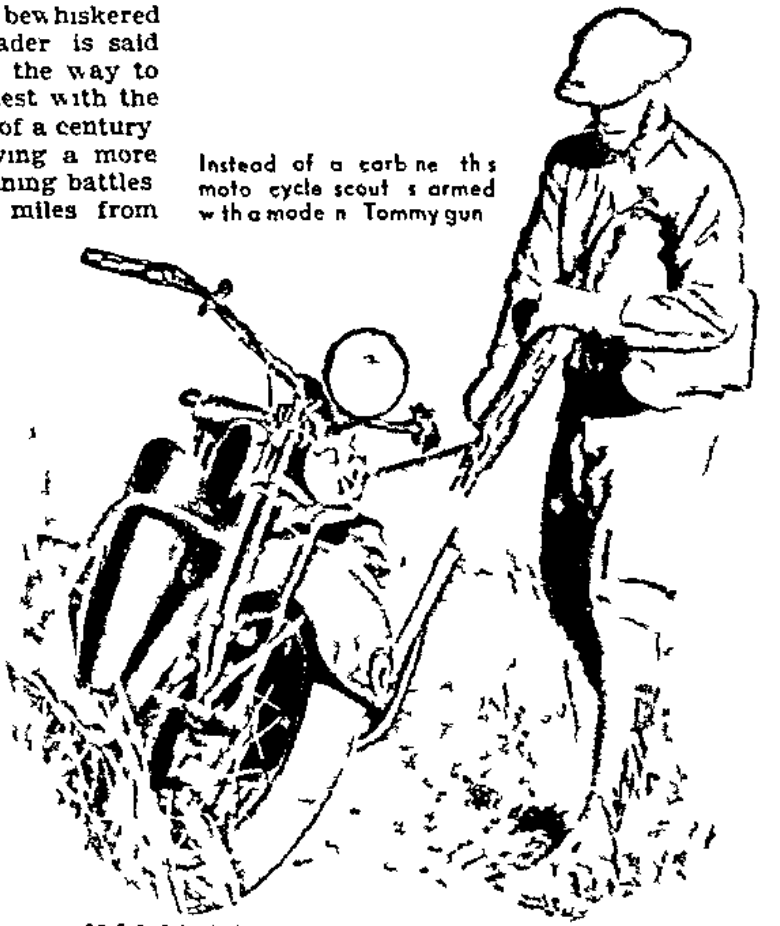
Cavalry cha ge new style
A combat car of the Mech
an zed B gade n act on

By ARTHUR A. STUART

OLD Bedford Forrest the bew hiskered Confederate cavalry leader is said to have remarked that the way to win in war is to git thar fustest with the mostest After three quarters of a century no one has succeeded in evolving a more generally useful receipt for winning battles

At Fort Knox twenty odd miles from Louisville Ky is stationed the Army s most modern im plement for gitting thar fust est with the mostest —the fast moving and hard hitting mechanized force which is des gnated officially the Sev enth Cavalry Brigade (Mech anized) but which the Army prefers to call the iron cav alry

In this supermodern caval ry the armored fighting ve hicle has taken the place of the horse commands snap out of radio receivers instead of ringing from brazen trum pets the staccato machine gun has superseded the gleaming saber and the monkey wrench has taken the place of the pitchfork But in spite of all these changes and innovations the iron cavalry still is cavalry The troopers talk about engines and transm ssion systems instead of about horses an l saddles but they are trained to think fast and to act fast



Instead of a carb ne th s moto cycle scout s armed w th a mode n Tommy gun

and boldly and so to carry on the great tra dition of American cavalry

The iron cavalry has the true cavalry sp rit and it is armed equipped and trained to do the traditional work of cavalry in war —to carry out distant scouting missions to seize critical pos tions and hold them until the infantry has time to come up to guard the army s flanks to attack the enemy s flanks and go swinging around them to raid his communicat ons and destroy his supply depots to pursue a beaten enemy When conditions of ground and weather are fa vorable for its use the Mechanized Brigade is best suited to do many of these things because it can go farther faster and hit harder when it gets there than can horse cavalry

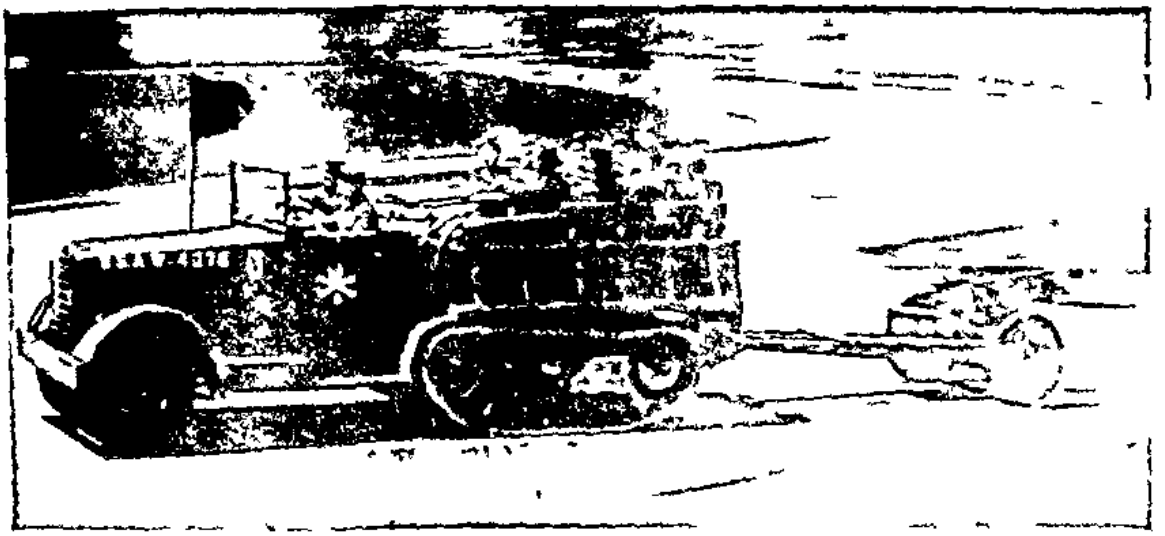
The Mechanized Brigade consists of a brigade headquarters troop two fully mech anized regiments of cavalry a battalion of field artillery which has four motor drawn firing batteries each of four 75 millimeter howitzers an ordnance maintenance com pany for the fighting vehicles and a quarter master maintenance company for the trucks and other vehicles a signal detachment for radio communication a medical troop and a squadron of observation aviation Its present authorized strength is about 2 000 men but it is hoped to double its strength both in men and fighting vehicles

THE backbone of the mechanized force s fighting power is its armada of 112 com bat cars—two two troop squadrons of them in each of the cavalry regiments

Cavalry combat cars are light tanks with full track laying mechanism They have the same engineering features which make our infantry light tanks the world s best—airplane type air cooled engines which are more power ful than the engines of any other country s light tanks (see page 93) dependable transmission



Mach ne gunners d smount f om a half track personnel carr e Below observat on squad on planes in fl ght over a l ne of combat cars



"Bringing up the guns The gun crew rides in the same vehicle that tows the 75 millimeter howitzer

and drive, and long-wearing tracks of rubber composition set in steel blocks which have proved that they can stand up under even the intense heat generated by the friction of long, fast marches over sun-baked southern hill roads A few of the combat cars have Diesel engines

Weighing nine and a half tons, the combat cars—the troopers call them "hell buggies"—are a couple of tons lighter than the infantry light tanks, and they are faster and more maneuverable Their top road speed is better than fifty five miles an hour, and they can "cruise at forty-five miles for long stretches without unendurable strain on either machines or crews Cross-country, their top speed is considerably in excess of twenty miles an hour over average ground, and their obstacle climbing is spectacular Because of their lighter weight, their armor isn't so thick as that of the infantry tanks The iron cavalry is willing to sacrifice some degree of protection to get more speed.

Another feature in which the combat car differs from the infantry tank is that it has one turret instead of two, and that its guns may fire in any direction The crew consists of four men and the armament of one 50 caliber and three 30 caliber machine guns—one of the latter in an antiaircraft mount. Each car also carries a Thompson submachine gun for close quarters fighting, and each crew man is armed with a 45 caliber automatic pistol This heavy armament gives the combat cars tremendous fire power They also may be used as shock weapons They won't be wasted in an attack on an enemy's carefully prepared main position, but when the right opportunity for their use arrives their thundering, lurching advance in fire spitting waves will be the machine-age version of the boot-to-boot charge of yelling, saber brandishing troopers

In addition to its two squadrons of combat cars, each of the mechanized cavalry regiments has a reconnaissance troop and a machine-gun troop

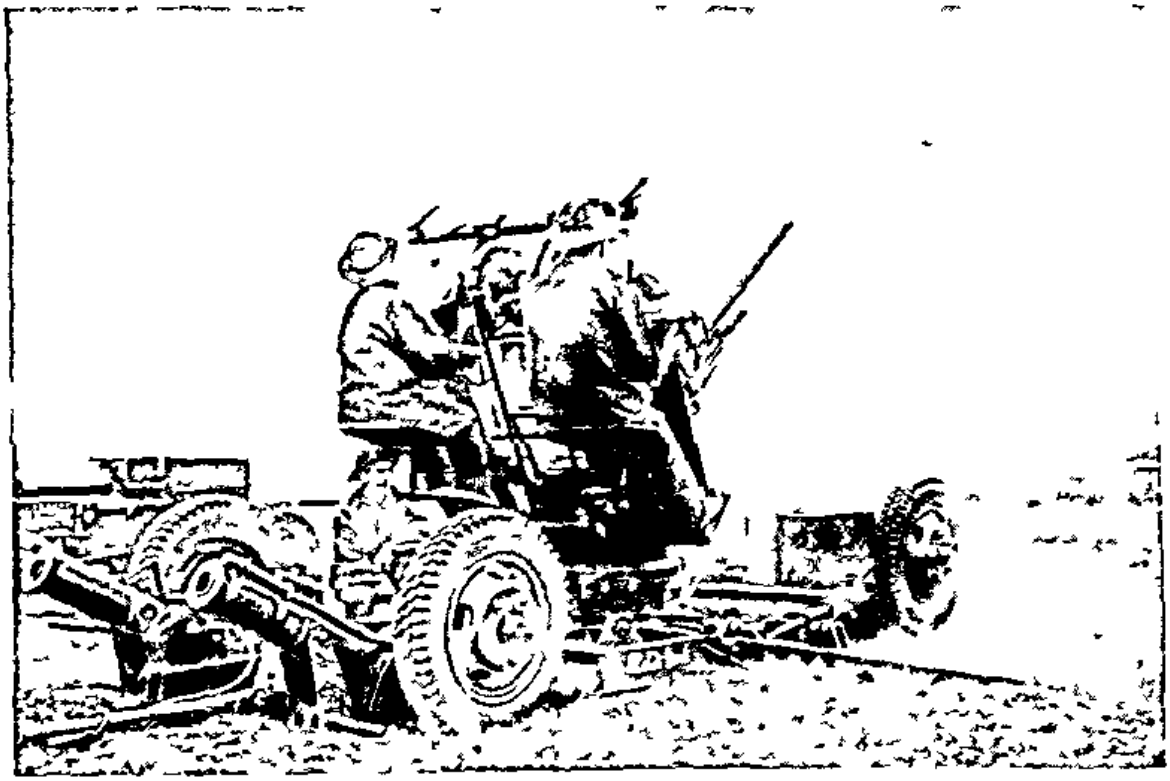
The job of the reconnaissance troop is scouting—especially long distance scouting One of the regiments is equipped with scout cars for this purpose, and the other with armored cars The scout car is a fast, four-wheel drive vehicle with high sides of light armor It carries a crew of from six to eight, and its armament consists of three machine guns mounted on a rail running entirely around the car's top, giving the gunners an all-around field of fire The armored car is a six-wheel, rear-drive vehicle closed in over the top by a turret.

The business of the machine-gun troop is to cover the advance of the combat cars with their fire, and to give the iron cavalry increased defensive power when it is necessary for it to hold a position against an attack. The machine gunners do most of their fighting on the ground, but they ride to the scene of action—the troop of one regiment in scout cars, and the troop of the other in half-track personnel carriers The latter are light trucks with the rear wheels replaced by a track-laying mechanism

ANOTHER distinctive type of combat vehicle used by the Mechanized Brigade is the mortar mount, a specially built four-wheel armored truck carrying a smoke mortar which its crew can dismount and set up to lay down a smoke screen to cover the advance or withdrawal of the brigade

Motor cycles are used for various purposes, their riders being armed with rifles or with the submachine guns which the troopers call "Tommy guns'

To keep up with an outfit which can move as fast and as far *(Continued on page 222)*



U. S. Army Gets a New Antiaircraft Gun

SAID to be effective against low flying bombers as well as hedge hopping attack planes the antiaircraft gun pictured in action in the photograph above is one of the U S Army's newest weapons for defense against possible enemy air attacks. Capable of being towed from one position to another at high speed, the thirty seven millimeter gun fires at the rate of 125 shells a minute Each projectile weighs one and a third pounds.



Rear view of the torpedo m ne Sound waves guide it to its prey

Electric Ears Aim Odd Torpedo Mine at Enemy Vessel

HUNTING its prey with elec tric ears another version of the sonic torpedo (P S M. Mar '40, p 78) combines features of a mine and a torpedo Four feet long and weighing 150 pounds the torpedo-shape unit has twin propellers and a rud der In use, the weapon is anchored under water By means of an electrical mecha-nism, the noise created by the propellers of an approaching ship causes the mine to release its anchor and starts its pro-pellers whirling Guided by the sound waves set up by the ship the torpedo-mine steers straight at its objective ex ploding on contact.

Model Shows Tooth Formation



Dr Moses D amond with the giant model of an embryo tooth (00 t mes natural s ze At upper left the h nged top has been l fted

Tracing projected cross sect ons (top) and cutt ng them out of plast c

TO DEMONSTRATE their discovery of the exact manner in which enamel is formed on teeth Dr Moses Diamond and Joseph P Weinmann of the Columbia University School of Dental and Oral Surgery recently constructed a novel plastic model of an embryo tooth which is exactly 100 times the size of the original The original tooth was first dissected by the investi gators into microscopic cross sections which were mounted on glass slides. These were then projected onto tracing paper, enlarged to 100 times their size These projected images were traced on the paper which was then laid over sheets of a special plastic material By gentle hand pressure the tracings were transferred to the surface of the plastic, and the outline cut out with a knife Cross sections of the original tooth varied in thickness from two to five microns or thousandths of a millimeter, so the plastic enlargements were therefore made from 200 to 500 microns thick When the entire number of cross sections had been completed they were placed one over the other in the same respective positions as the original tooth sections thereby producing the tooth model. Two and a half feet long the tooth model has its upper half hinged to the lower so that interior details may be examined.

How Plant Doctors

A plant doctor's laboratory—citrus trees growing in garbage cans filled with nutrient solution. Serving as test specimens these trees are inoculated with disease germs to determine their resistance

Boring a hole in a tree to inoculate it with virus as at right

Protect Our Crops

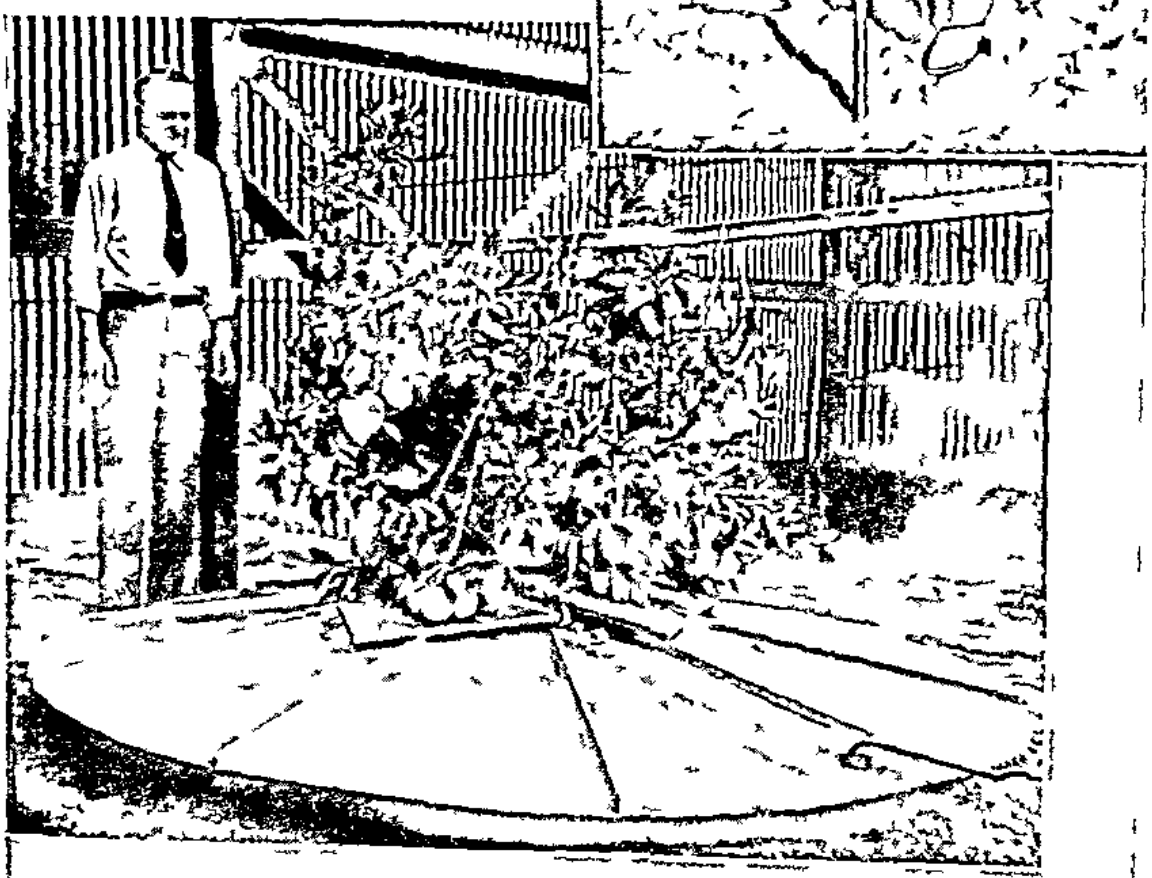
Tree Diseases Studied Like Human Ailments

MORE than sixty scientists attached to the University of California's Citrus Experiment Station at Riverside are concentrating on a battle against the diseases that threaten countless acres of citrus groves and deciduous fruit and date orchards of the southwestern United States. Were it not for their activity in tracking down mysterious plant infestations, devising preventives and cures through ceaseless laboratory experimentation and developing disease resisting varieties, the nation's supply of oranges, lemons, dates and other fruits might be seriously curtailed and the loss to fruit growers would run into millions of dollars in a short time.



Gas pumped into the ground with this hypodermic prevents spread of fungus to date trees

An orange tree growing in a 1,300 gallon tank. If it passes tests it will be employed in crossbreeding

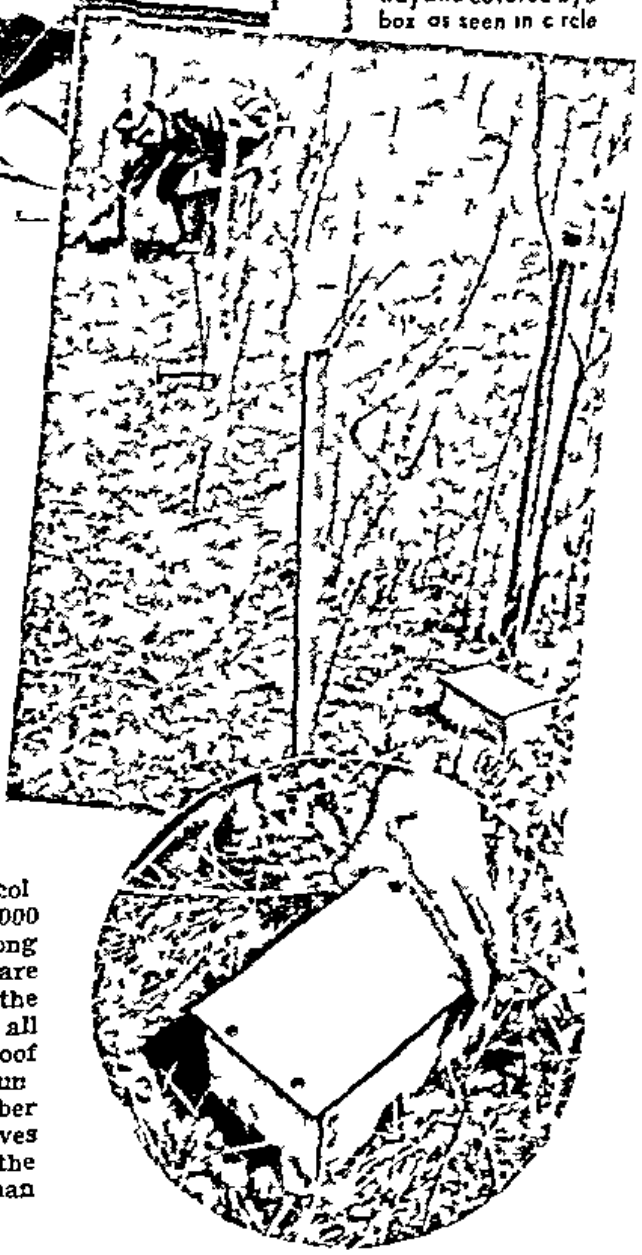


Scientists Run Mouse-Trap Line



One of the mouse trappers examining a trap of the kind used Beside him is a tray of specimens for study

Below is a section of the line Stakes mark trap locations Each trap is set in a runway and covered by a box as seen in circle



IF A certain number of mice are living on an acre of land one year there may be six times as many there next year or there may only be half as many Why? What causes animal populations to move in cycles? How long or how frequent are the cycles?

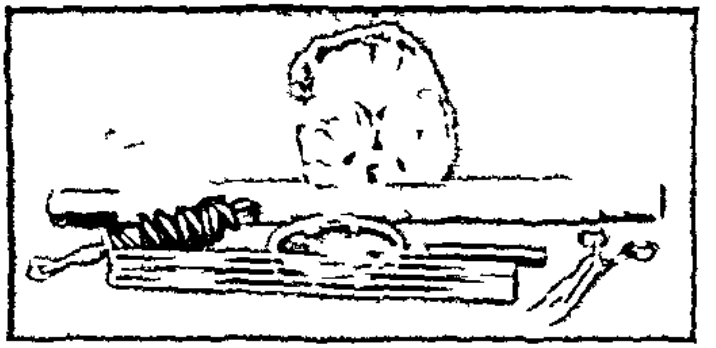
To solve these questions in the riddle of animal population changes B P Bole Jr and Philip N Moulthrop of the Cleveland Museum of Natural History have established a trap line they hope to maintain for fifty years By trapping every day except Sunday over that period the mice inhabiting a circular half acre of ground in Kirtland Hills Ohio the scientists hope to assemble mouse population figures that will unlock the mystery They may be able to predict the approach of mouse years and thus give advance warning against rodent damage And the traps form a means of building up the museum's mouse collection which now numbers more than 15,000 preserved mice and is used to study among other things rodent diseases some of which are suspected of being related to human ills On the circular trapping area, 100 traps are set at all times each being covered with a weatherproof box and placed in a hole that cuts into an underground mouse runway Each day a member of the museum staff visits the scene removes the catch and resets the traps Figured on the fifty year basis that means that more than 15 000 visits will be made to the trap line

Rubber Film Preserves Specimens for Medical Demonstrations



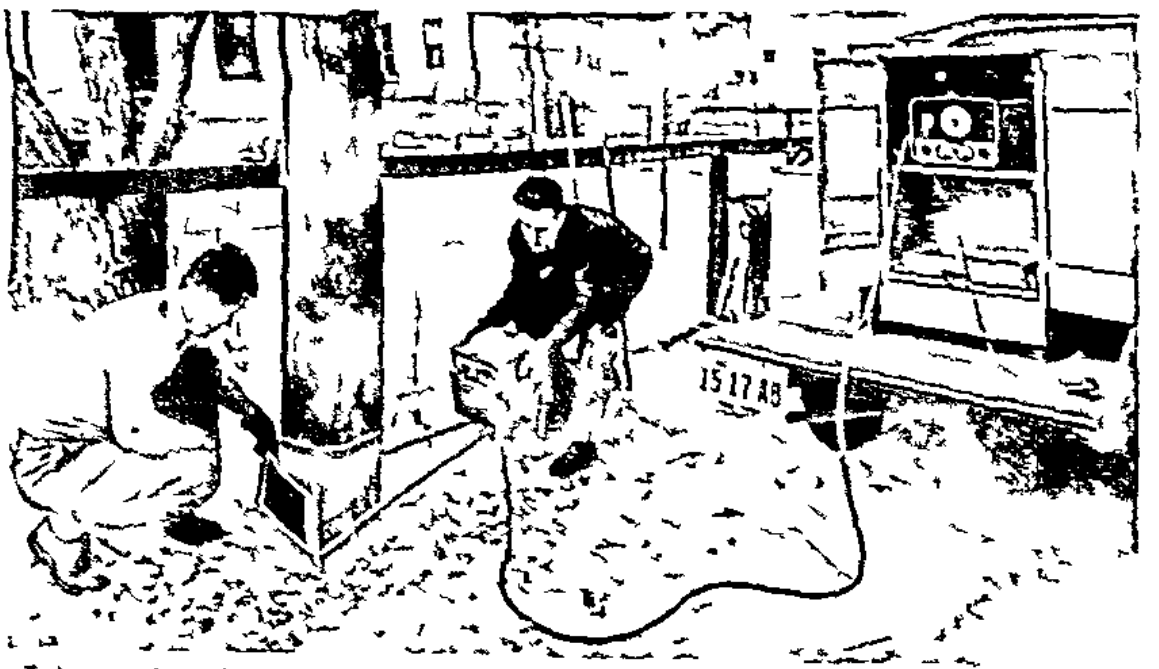
Sections of human brain wrapped in transparent film. At the right is the equipment used in preparing them

ENVELOPES of a transparent rubberized material are being used by a Boston, Mass., neurologist for preserving sections of human brain and other medical specimens employed in lectures and demonstrations. After a month's treatment with a preservative, specimens are placed in the transparent sacs which are then sealed by heat. In this form the material is handled and transported easily.



X Rays Spot Decayed Power-Line Poles

WOODEN poles that support electric light wires are now being X rayed to determine whether they are sound or decayed to the point of requiring replacement. A Detroit, Mich., utility company utilizes a portable X ray unit inclosed in a cabinet mounted on a small truck, as shown in the photograph. The poles are photographed at their bases, just below the level of the ground where decay is most prevalent. Boring is the orthodox method of testing the poles for decay, but the X ray system, in recent tests, is said to have proved more accurate and less wasteful.

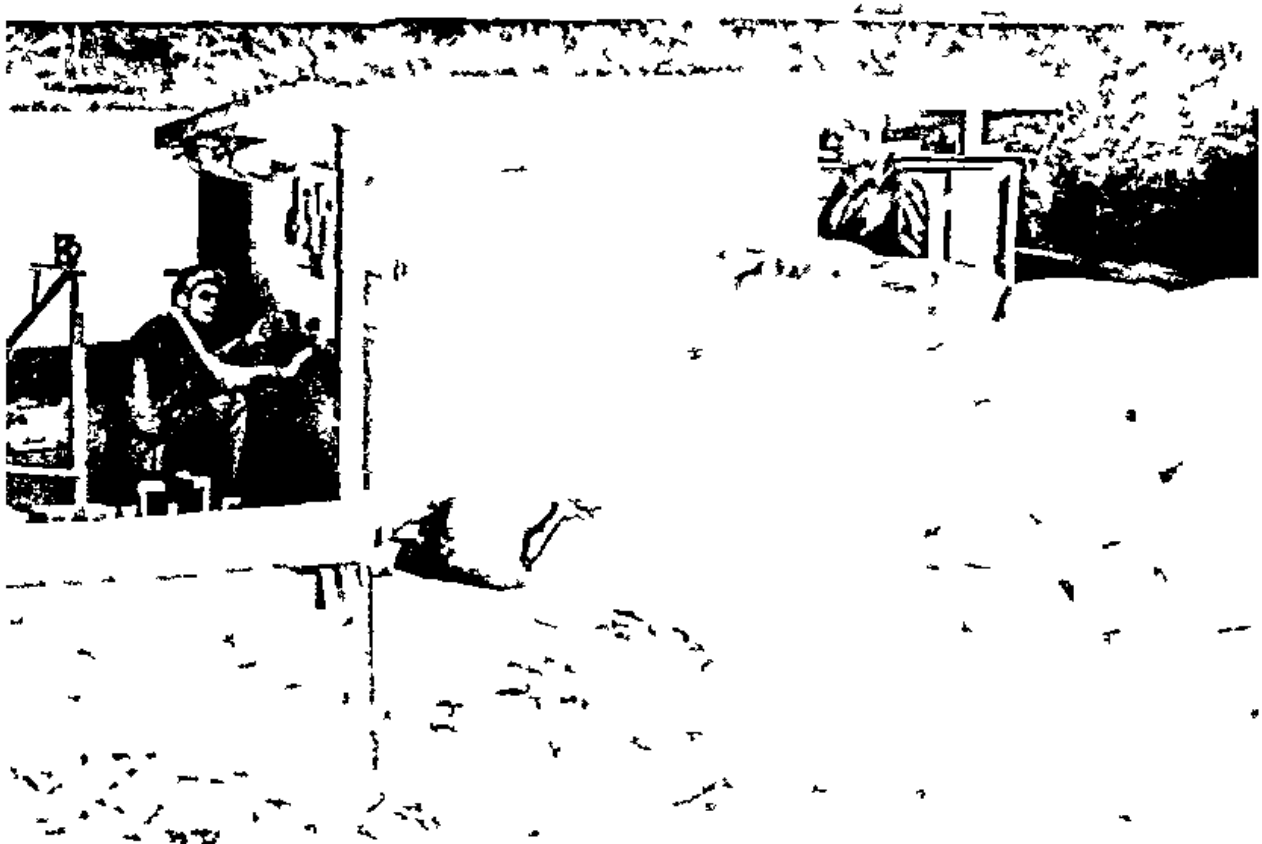


Testing a pole for decay. X rays are aimed slantingly downward through the wood just below ground level

NEW EXPERIMENTS WITH ROCKETS

PROTECTED against deadly explosions by a wall of sandbags and heavy timbers two young California Institute of Technology scientists feed explosive gases under pressure into the motor of a rocket At the touch of a button a leaping spark ignites the mixture and with a roar a sheet of flame and a cloud of smoke the gases go into action Operating a camera one of the researchers photographs a battery of instrument dials that reveal such vital facts as the thrust of the motor and the weight and pressure of the gases surging through pipes from metered chambers

But the rocket itself instead of soaring into the heavens remains rooted on the ground since it is

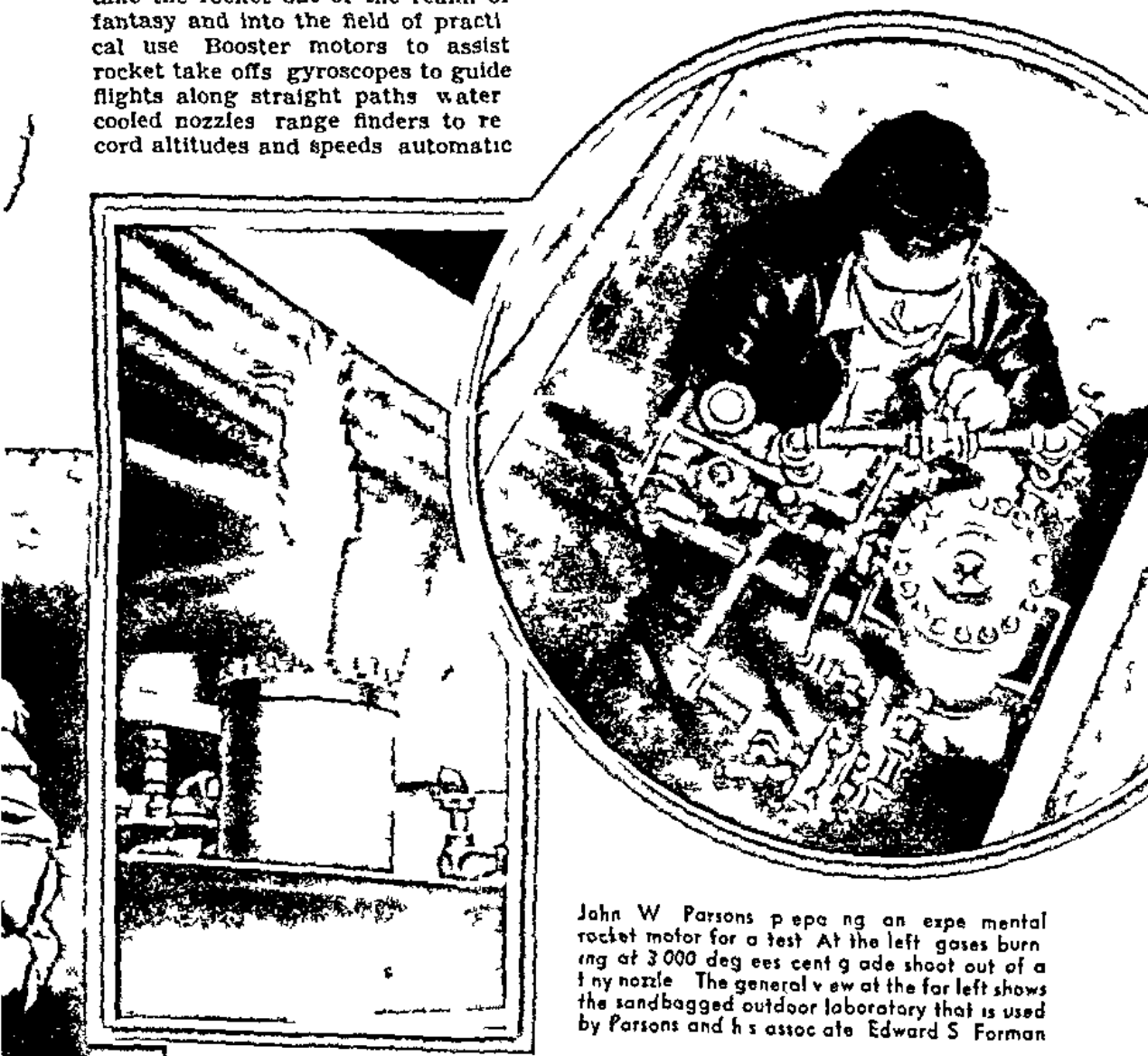


anchored in place and pointed earthward For Fdward S Forman and John W Parsons the California rocket researchers are mainly interested for the present in studying the action of various fuels for stratosphere stabbing rocket ships and the effect of their intense heat on various types of nozzles

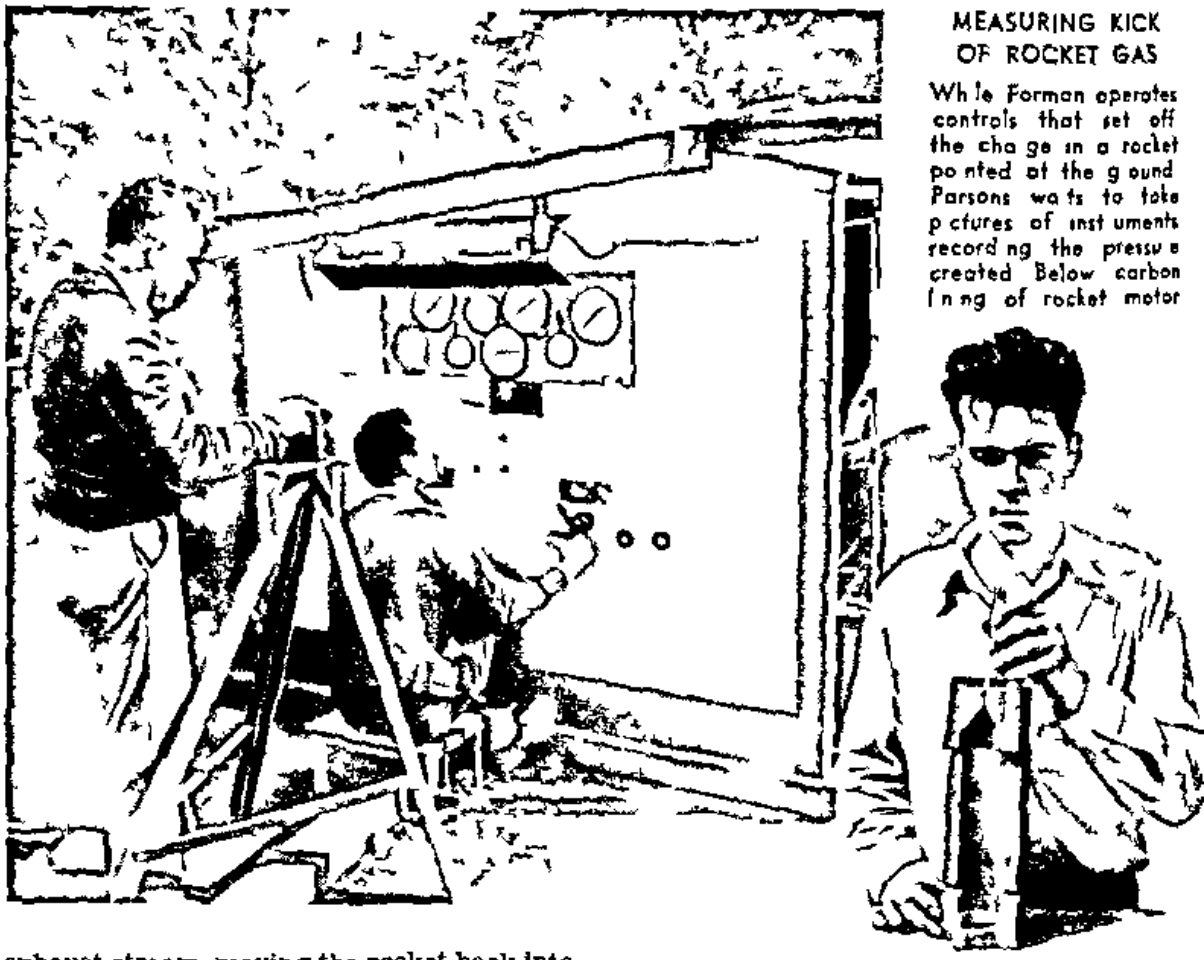
This question of rocket motor nozzles is one of the major problems now facing rocket experimenters who are constantly devising new improvements and new methods to take the rocket out of the realm of fantasy and into the field of practical use Booster motors to assist rocket take offs gyroscopes to guide flights along straight paths water cooled nozzles range finders to record altitudes and speeds automatic parachutes that return the rockets safely to earth—these are some of the devices that are now being tested and brought to perfection by laboratory experiments on a dozen fronts

North of Roswell N M for instance rockets wobble skyward from a sixty foot tower and then straighten out into a true vertical path soaring up two miles into the air at a speed of more than 700 miles an hour At the top of their flight they hang in air a split second then tumble over and float gently down to earth as their parachutes automatically belly out The gyroscopic mechanism that straightens out the initial take off wabble is a development engineered by Dr Robert H Goddard rocket pioneer Stabilizing vanes attached to the rocket are automatically controlled by the gases of the

By ROBERT E. MARTIN



John W Parsons preparing an experimental rocket motor for a test At the left gases burning at 3 000 degrees centigrade shoot out of a tiny nozzle The general view at the far left shows the sandbagged outdoor laboratory that is used by Parsons and his associate Edward S Forman



MEASURING KICK OF ROCKET GAS

While Forman operates controls that set off the charge in a rocket pointed at the ground Parsons waits to take pictures of instruments recording the pressure created Below carbon lining of rocket motor

exhaust stream moving the rocket back into line when it wanders ten degrees away from a vertical path

But actually how close is rocket science to practical exploration of the *stratosphere* at an altitude of say fifty miles? Studies at the California Institute of Technology lead investigators to believe that with the exhaust velocity of 7 000 feet a second obtained by Goddard s rockets powder *rockets* could now be built capable of rising 100 000 feet. In fact, under some conditions they believe a gas propelled eighty five pound rocket exhausting its burned fuel through a nozzle at the rate of 12 000 feet a *second* could rise under power to an altitude of fifty miles and then continue coasting straight up for another 175 miles

For more than three decades scientists have sought ways to explore the atmosphere at great heights Today their thoughts are turning to levels where rockets would fly through a vacuum and celestial observations might be made without interference from city lights haze clouds or air molecules of lower altitudes One well known astronomer even went so far as to suggest the possibility of a complete astronomical observatory raised a thousand miles above the *earth by* one set of rocket motors and maintained at that level by another

Of more immediate practical application is the proposal that rockets take over the duties of heavy artillery in laying down a concentrated bombardment of an intensity not reached even with dive bombing air *planes and* the latest type of field and rail way guns Major James R. Randolph of the *U S* Army Ordnance Reserve recently declared that rockets could easily equal the *performances* of long range guns firing shells as far as seventy miles

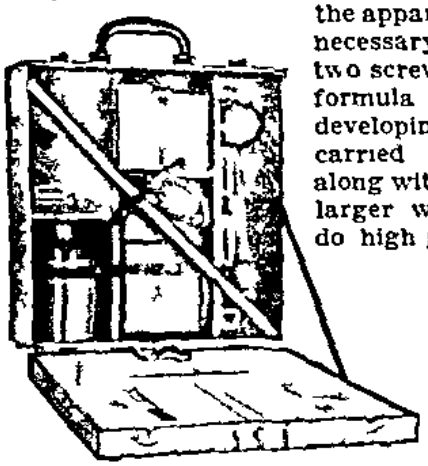
These long range cannon fire a *projectile* eight inches in diameter Instead of firing shots of moderate caliber at long intervals said Major Randolph, a *rocket* plant could fire the equivalent of twenty four inch shells as fast as desired

Projectiles envisaged by this officer would weigh four tons Thousands of them *set off simultaneously* or in volleys might lay down in a few minutes a withering *barrage* that present artillery could equal only over a long period of time

Armor piercing rockets Randolph further proposed could be carried by submarines while on land the rocket shells could be *transported* in ordinary motor trucks bearing no resemblance to artillery weapons now easily identified by enemy planes

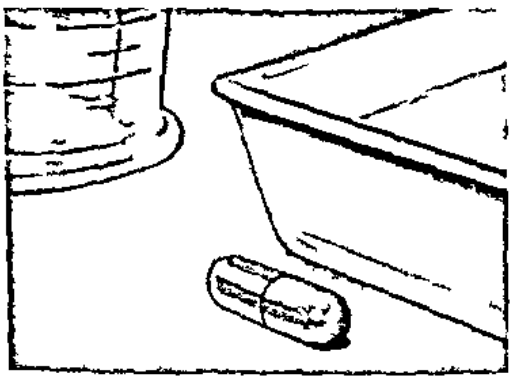
Portable Enlarging Outfit Fits in Traveling Case

So COMPACT it can be carried in a luggage type case only four inches longer than this page a new miniature enlarger permits travelers to turn any hotel room or tourist camp cottage into a darkroom for enlarging To set up the apparatus it is only necessary to tighten two screws Chemicals formula cards and a developing tank can be carried in the case along with the little enlarger which is said to do high grade work



Portable enlarger in its carrying case It makes a darkroom of any place you may be



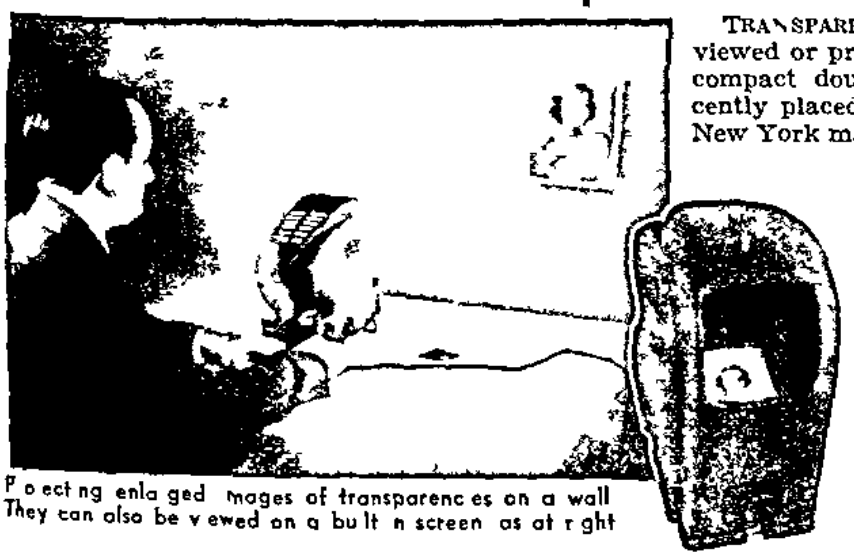


This capsule is dropped in the film container

Sensitizing Powder Comes in Handy Capsule Form

STEPPING up the speed of either movie or still film from fifty to 100 percent hypersensitizing chemicals in powder form are now offered for sale in capsules To increase the speed of the film all that is required is to drop one of the capsules in the film container and leave it there the required length of time The chemicals in the capsule which will keep for years according to the manufacturer act upon the emulsion and increase its sensitivity There is nothing to spill or come in direct contact with the film

Combined Film Projector and Viewer



Projecting enlarged images of transparencies on a wall They can also be viewed on a built in screen as at right

TRANSPARENCIES can be either viewed or projected by means of a compact double duty accessory recently placed on the market by a New York manufacturer When the transparency is slipped into place a movable mirror throws the image on a viewing screen If the user desires to see the picture enlarged he simply turns a knob and the mirror swings out of the way permitting a lens to project the magnified picture on a wall or screen for more detailed examination

New Accessories for



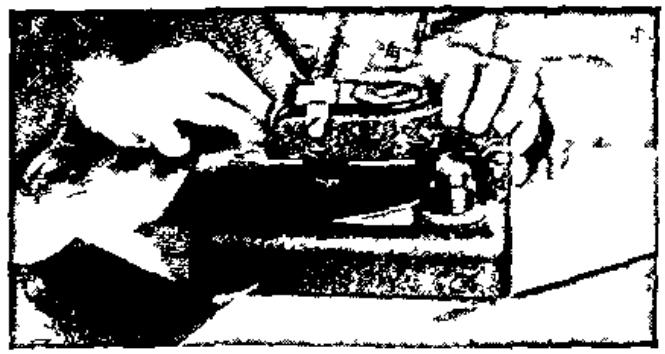
The color ng flu d s made by d ssolv ng strips of paper in water

Prints Colored with New Tints Are Ferrotyped

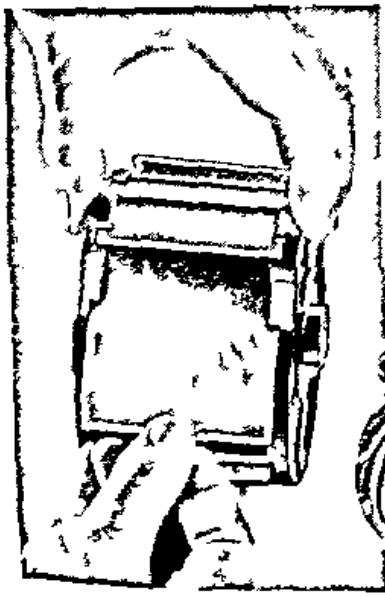
COLORED photographs now can be ferrotyped and given a high gloss through the use of chemical tints which are sold in blotterlike strips and applied with pipe clean ers for brushes When pieces of the strips are dropped in water they produce the coloring fluid used on the photographs This fluid sets quickly so the print can be soaked in water after the coloring is completed and then ferrotyped

Exposure Meter Shows Density of Negatives

FOR DETERMINING the relative densi ty of color separation negatives a new device makes use of a conven tional photo electric exposure meter The meter is placed on top of the apparatus where it receives light pro jected upward through a negative The denser the negative the less the light reaching the meter A special scale attaches to the regular meter



Us ng an exposure meter to gauge dens ty of negat ves



Compact Circular Developing Tank

Parts of the new c rcular develop ing tank shown assembled at left



MORE compact than the conventional rectangular developing tanks for cut films and film packs a new circular product with a spiral groove reel per mits the amateur to de velop his films with a minimum of chemi cals according to the manufacturer By sliding the top section of the synthetic resin reel up or down films ranging all the way from 35 millimeters to 2½ by 3½ inches can be accommodated.

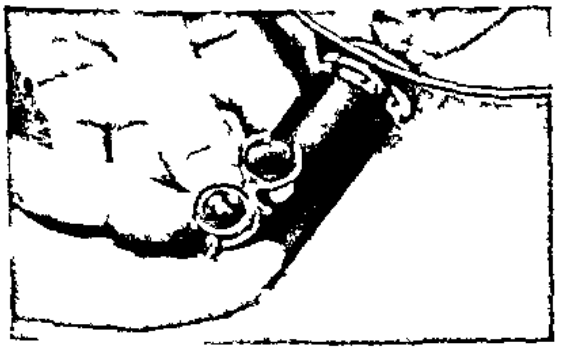
Camera Enthusiasts



An opaque coat ng keeps l ght from leak ng from the neck of th s bulb At the r ght two lamps are in use

Light-Tight Necks for Photoflood Bulbs

BLACK necks on mushroom type photo flood bulbs now prevent stray light from spilling out and shining in the lens of the camera. Such lamps are designed with an interior aluminum reflecting surface which makes the use of a conventional reflector unnecessary The new opaque coating extending from the base of the lamp to a point beyond the beginning of the reflecting surface makes the neck light tight



Socket Adapters Center Midget Flash Bulbs

TO CENTER midget photoflash bulbs in standard size reflectors nickel plated socket adapters are now available One end of the device screws into the regular socket of a flash gun The other is slotted to provide a bayonet lock which facilitates rapid reloading One size of the adapter with a short stem is for small reflectors another size with a longer stem for large ones

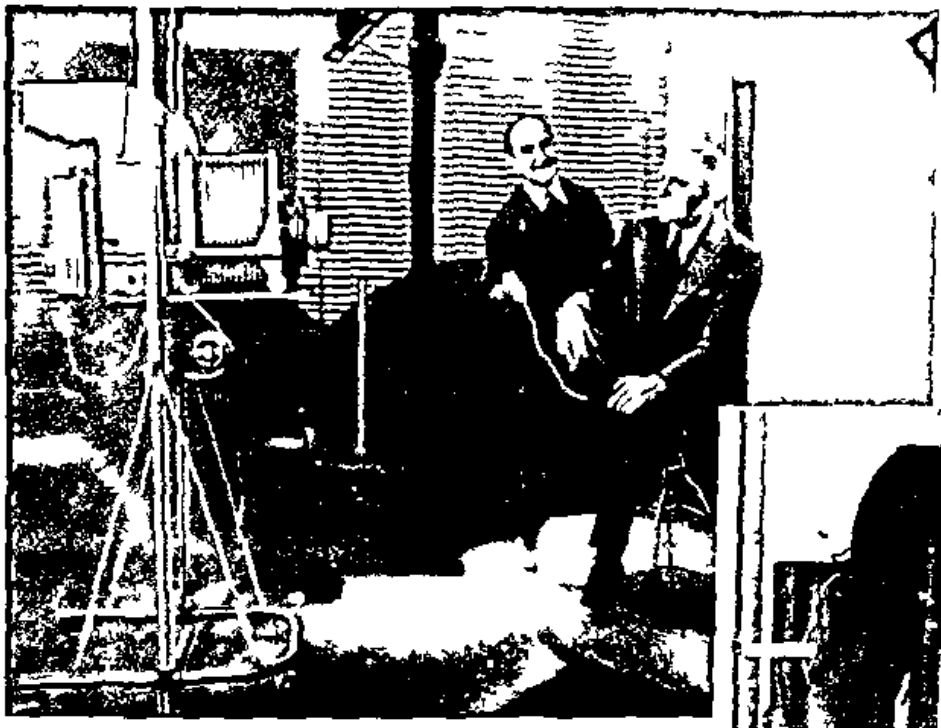
Spotlight on Flash Gun Aids Focusing in Dark

FOCUSING in reduced daylight or at night is simplified by a small spotlight which plugs into the battery case of an American made flash gun Whenever there is insufficient outside lighting for using the range finder or the ground glass of the camera for focusing the beam of the little spotlight will provide a spot of illumination for the purpose The lamp can be plugged into the flash gun outlet in a moment. The attachment also provides a test for the strength of the flash gun battery

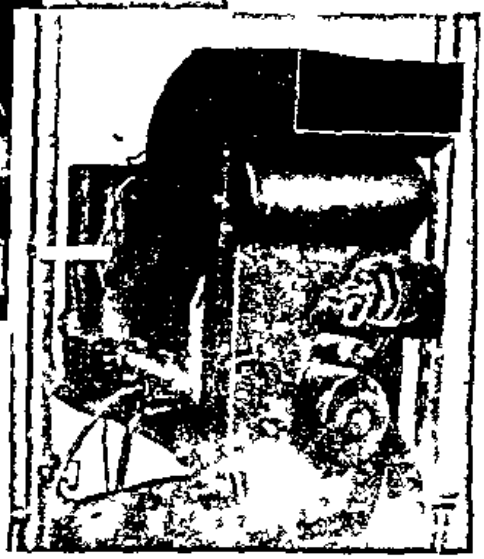


Two adapter s zes su t large or small reflectors

Studio Camera Is Remotely Controlled

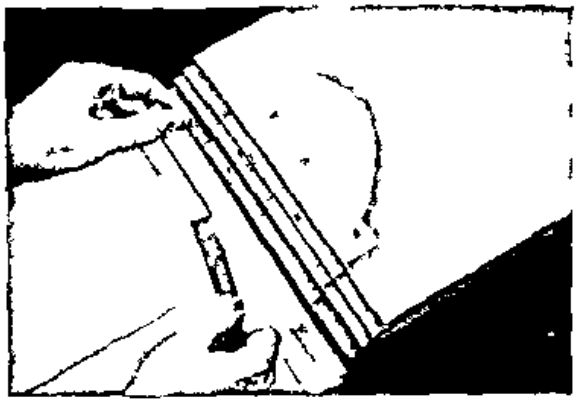


With this electrically operated camera a photographer snaps the shutter from any point



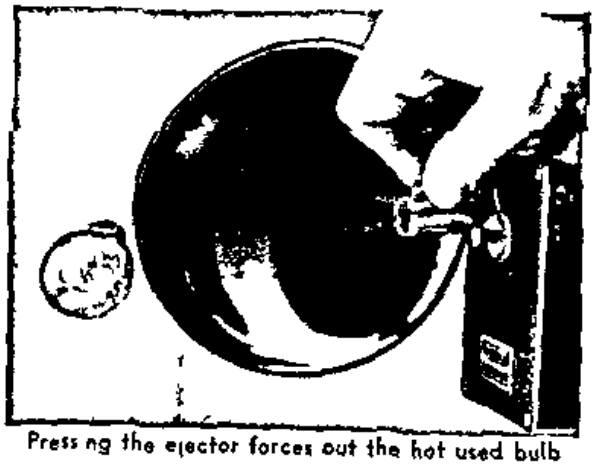
Below a rear view showing motor that turns the film and shutter speed dial

ELECTRICITY operates a new studio camera which George M Walters a California photographer has perfected after sixteen years of research A remote control cable and switch enable the photographer to snap the shutter from any point in the studio The electrically operated shutter permits 1/1 000th of a second snapshots



New Extension Adapter Ejects Used Bulbs

BURNED fingers are prevented by a new extension adapter for synchronizers which contains a built in ejector for peanut size flash bulbs Slight pressure on the ejector forces out the hot used bulb and makes handling unnecessary

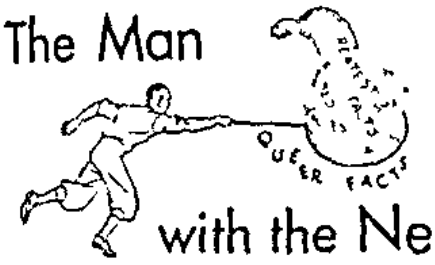


Pressing the ejector forces out the hot used bulb

Enlarging Paper Packed in Perforated Envelope

TO SAVE trouble for the darkroom worker one American manufacturer of enlarging paper is incorporating a perforated strip in the flap of the package By gripping a tab at the end of the strip and pulling sidewise the user can rip off the perforated section and quickly open the package leaving a narrow flap to protect the contents

The Man with the Net

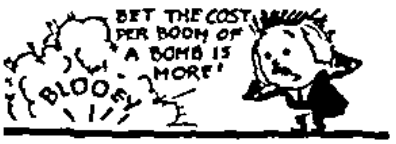


RAILROAD TIES *in the United States are replaced at the annual rate of 100 ties a mile*

HYDROCHLORIC ACID *is being used in England to give concrete highways a rough, nonskid surface*

FALLING *through the doors of moving automobiles kills an average of 300 persons a year in the United States*

AMERICAN *bombing plane engines cost approximately ten dollars a horsepower*



AUTOMOBILE TRAFFIC *in Times Square, New York City, averages six miles an hour, five miles an hour slower than the average speed of horse and buggy days*

RED BLOOD CELLS *are manufactured in the human body at the rate of 30,000 a second*

MOUNTAIN TOP LICHENS *it is estimated, live for 1,000 years*

PRUNE PIT OIL *has been found to be exceptionally rich in vitamin A*



KENTUCKY LEGISLATORS *once passed a law to the effect that Robert Fulton did not invent the steamboat*

EVERY SECOND *of the year, an average of about 16,000,000 tons of rain and snow fall on the surface of the earth.*

NOVA SCOTIA'S *coast line is three times as long as the entire Pacific coast line of the United States*

KANGAROO TAILS *provide fibers which are used for thread in certain types of surgery*



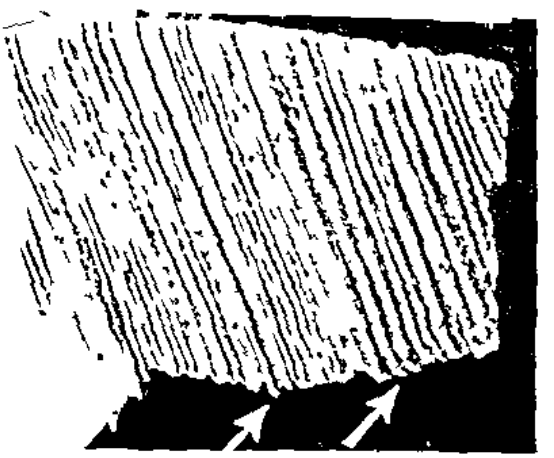


Spade with Two Handles Symbolizes Friendship

TWIN handles on a Y shaped spade recently enabled American and Canadian officials to symbolize friendship while breaking ground for a new Niagara Falls bridge

Ancient Sun-Spot Cycles Wrote Record on Clay

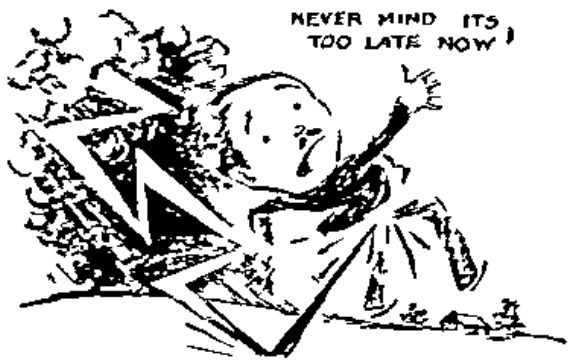
PREHISTORIC sun spots left their record on the clay bottom of a western river, scientists recently discovered Just as the growth rings of trees show that every eleven years a season of extra rain results from sun-spot activity so the clay deposits are thicker at similar intervals



Arrows show thicker layers caused by unusual rains

POPULAR SCIENCE Question Bee

We've added a little variety to our quiz for your entertainment. Try to pick the right answer to complete the first five sentences. Then follow instructions for the rest. Answers are on page 223



1 You would be safest from lightning *(a)* in swimming *(b)* standing beneath a tall, isolated tree *(c)* under your bed *(d)* within a steel framed office building

2 A diamond back terrapin is *(a)* a highly venomous snake *(b)* a piece of expensive jewelry *(c)* a turtle prized as a table delicacy *(d)* an issue of paper money guaranteed by Treasury deposits of diamonds.

3 If one of your car's cylinders fails to fire the trouble may be a faulty *(a)* spark plug *(b)* flywheel *(c)* transmission *(d)* odometer

4 To save weight in building ships and other steel structures riveting sometimes is replaced by *(a)* pickling *(b)* welding *(c)* vulcanizing *(d)* electroplating

5 A half hitch is a kind of *(a)* swimming stroke *(b)* auto-trailer coupling *(c)* knot *(d)* belt for a repair man who climbs telephone poles

Answer "Yes" or "No"

If you aren't sure try for a good guess

6 Are bats blind?

7 Do U. S. battleships fire torpedoes?

8 Should a hack saw be used to cut metal?

9 Is a spider an insect?

10 Can the pilot of a motorless glider ever soar higher than his point of take-off?

Censored Sentences

Each dash stands for a letter in the same missing word in each sentence

11 A ———— is a small burrowing animal but a ———— is also a skin blemish, or a ———— may be a breakwater to shelter a harbor

12 A carpenter smooths wood with a ———— three points determine a ———— a ———— is useful to an aviator

13 You would need a ———— to change a tire a deck of playing cards contains four ————s a ———— is a kind of flag telephone switch board connections are made with ————s

14 A carrot is an edible ———— two is the square ———— of four money has been called the ———— of all evil.

15 You could fill a drinking glass from the ———— a ———— is a light knock a machinist uses a ———— to form internal screw threads.

Pairing Them Off

Can you supply the missing word commonly associated with the other? Dashes represent letters

16 Flora and ————

17 Block and ————

18 Latitude and ————

19 Stress and ————

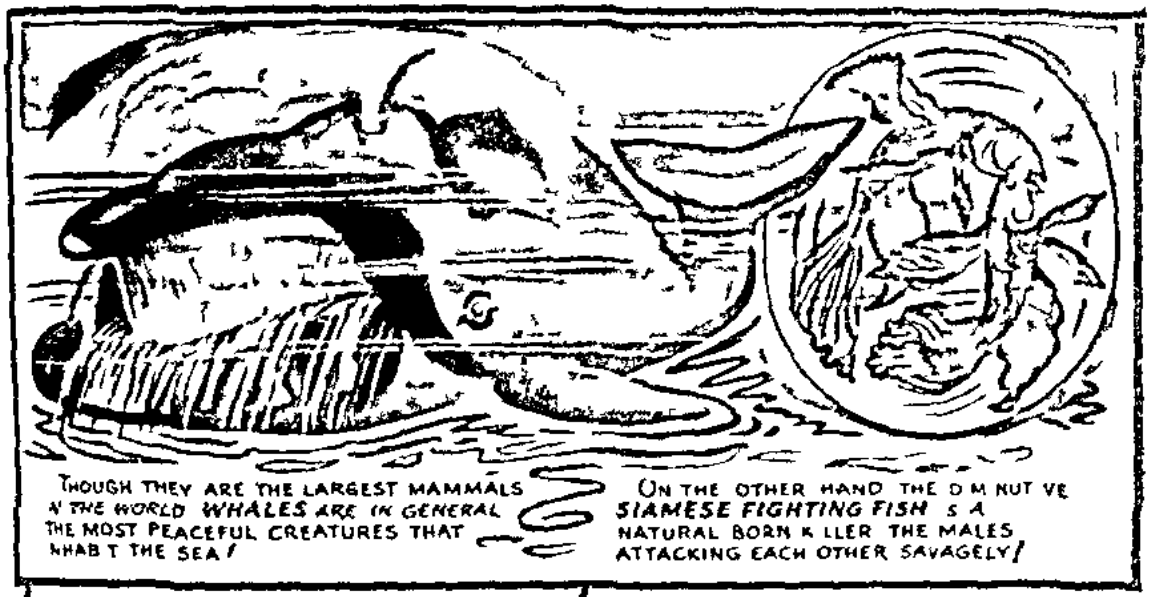
20 Brace and ————

Now YOU Ask US One!

We pay $1 for each question accepted. Address the Question Bee Editor, Popular Science Monthly, 353 Fourth Avenue, New York City

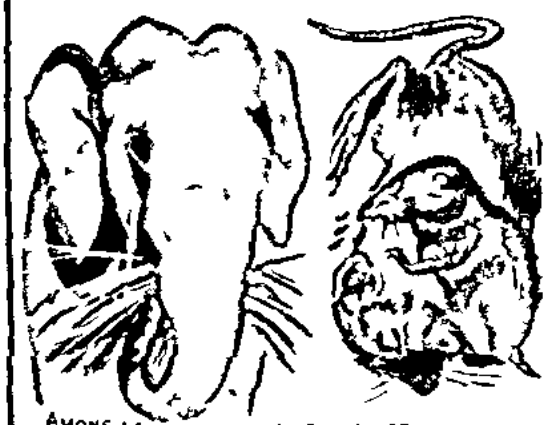
Un-Natural History

By Gus Mager



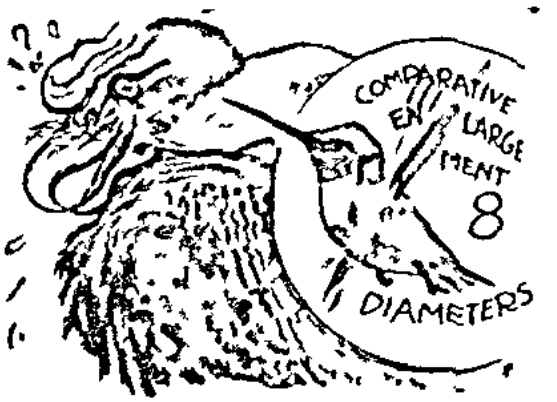
THOUGH THEY ARE THE LARGEST MAMMALS N' THE WORLD *WHALES ARE IN GENERAL* THE MOST PEACEFUL CREATURES THAT NHAB T THE SEA!

ON THE OTHER HAND THE D M NUT VE *SIAMESE FIGHTING FISH* S A NATURAL BORN K LLER THE MALES ATTACKING EACH OTHER SAVAGELY!

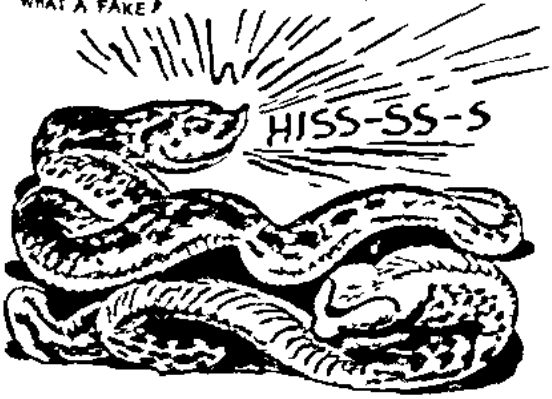


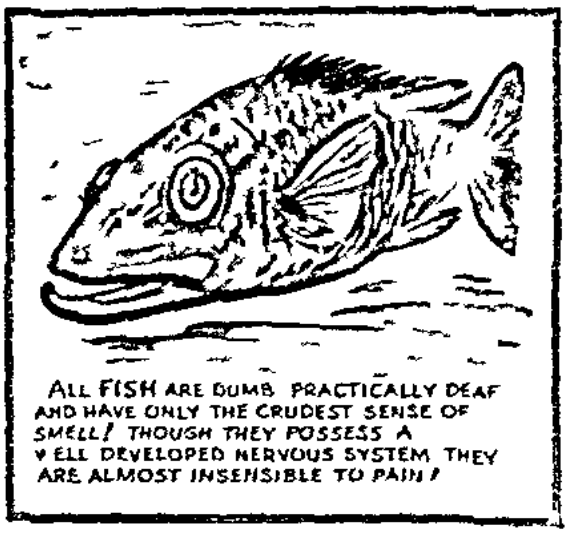
AMONG LAND AN MALS THE HUGE **ELEPHANT** IS AN INOFFENSIVE GRASS EATING BEAST WH LE THE TINY **SHREW** IS A VIC OUS MEAT EATER AND A CANNIBAL!

THAT B RD G ANT THE **CONDOR** S A COWARDLY CARR ON FEEDER BUT THE PYGMY **HUMMING BIRD** S A FEARLESS PUGNAC OUS SCRAPPER!

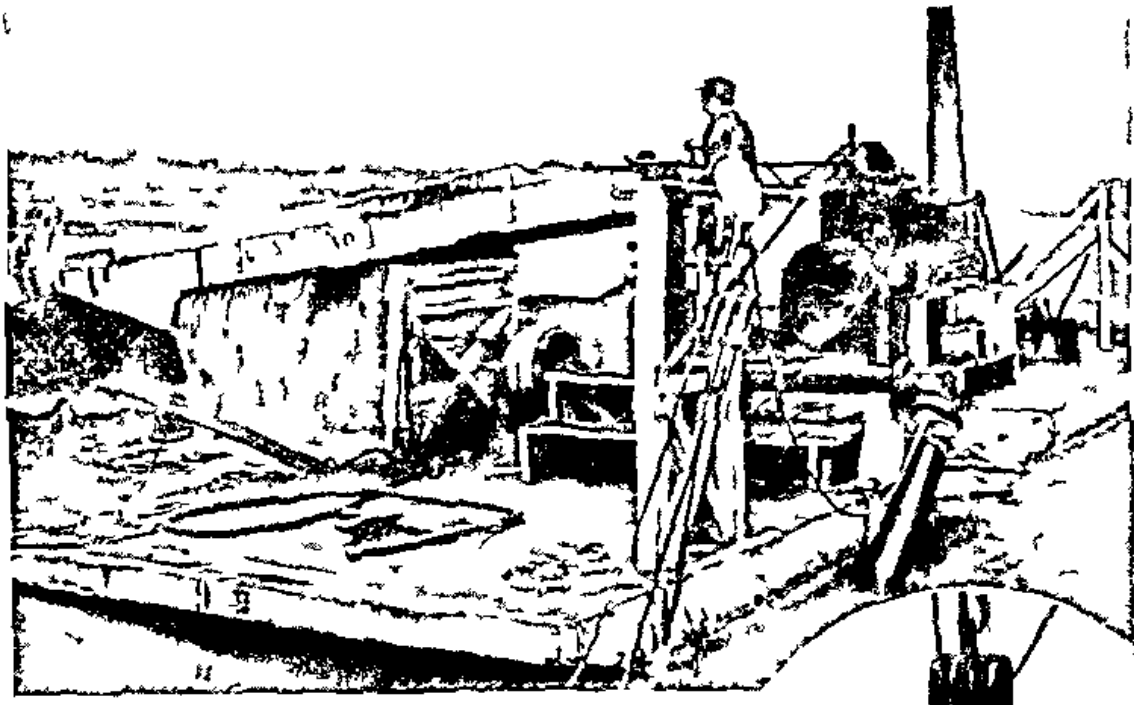


WHEN FR GHTENED THE **HOGNOSE SNAKE** PUFFS H MSELF UP TO LOOK LIKE A BIG DANGEROUS REPT LE IF THIS BLUFF DOESN'T WORK HE ROLLS OVER AND PLAYS DEAD! WHAT A FAKE!





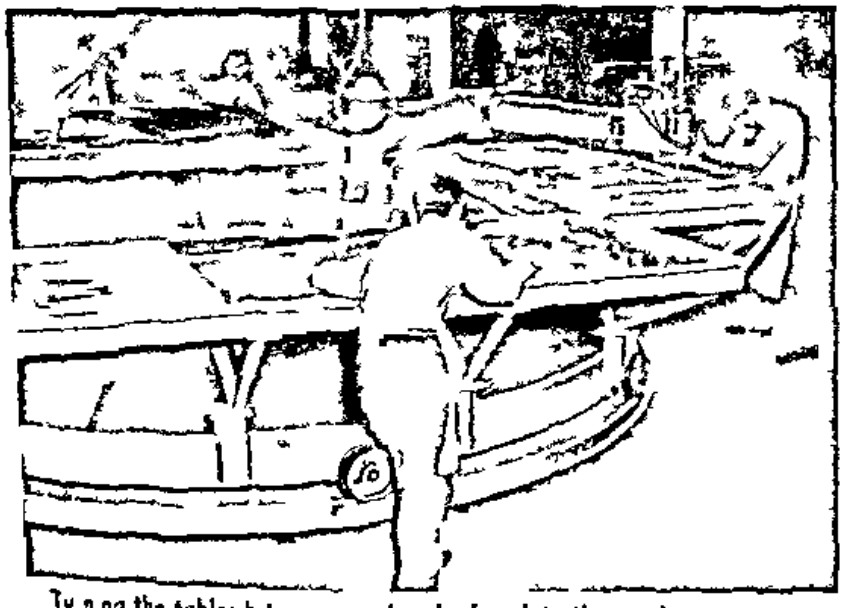
ALL **FISH** ARE DUMB PRACTICALLY DEAF AND HAVE ONLY THE CRUDEST SENSE OF *SMELL!* THOUSH THEY POSSESS A V ELL DEVELOPED NERVOUS SYSTEM THEY ARE ALMOST INSENSIBLE TO PAIN!



Sc een rg coal f om the m xtu e of mud and sand sucked f om a r ver bed by the vacuum cleaner seen at r ght

Coal Mined from River Bed with Pumps on Odd Barge

PFNNSYLVANIA miners are using an odd river barge to reclaim some of the fine particles of coal washed into the Susquehanna River from near by coal fields Through a pipe dragged along the river bottom coal mixed with mud and sand is pumped to the surface where it is extracted by screening



Tu n ng the tables brings a new batch of wo k to the mach ne operator

Tables Turn To Speed Up Production

TO SAVE valuable time four work tables are mounted corner to corner on a circular track in a Cal fornia aircraft plant When two operators have each routed a table load of sheet metal parts with routing ma chines mounted on swivel arms the tables are turned bringing a new batch of work in front of each operator without loss of time

Model Rooms Aid in Planning Decorations

TO ASSIST brides and other prospective home dec orators in planning the furnishing of various rooms before they set off on a buying spree a novel deco rating kit has been intro duced With scissors and paste floors and walls of in dividual rooms may be built to scale out of heavy paper Then various cut out forms representing furniture may be spotted about the model room to help the decorator decide what to buy and where to place it. Shopping lists and full directions are included in the kit



Plann ng decorat ons w th cut outs and a model room from the k t

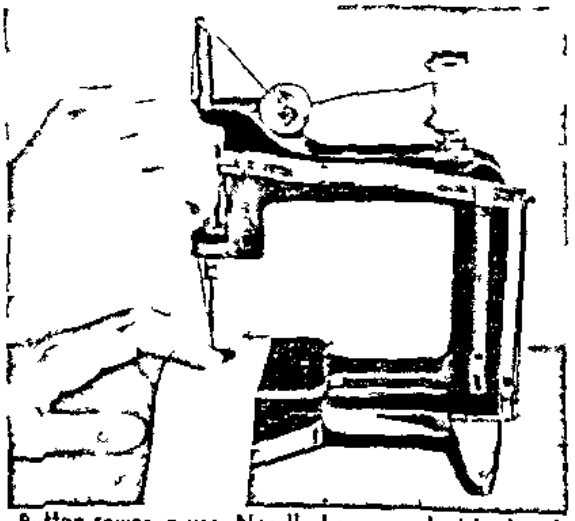


Chemically Treated Pads Keep Dogs' Coats Clean

COTTON pads saturated with a special lotion make it easy to clean dust and dirt from a dog s hair to keep the animal s coat in first class shape between baths Eight inches square and packed eight to a jar the pale blue pads contain a disinfectant as well as a cleaning agent The pads which may also be used to swab and clean cats fur are said to be harmless to even the most sensitive skin They are specially recom mended for the care of city pets

Button-Sewing Machine Does the Job Quickly

BUTTONS can be sewed in place within a few seconds with a novel machine invented by Harry A Landis of Red Lion Pa As shown in the photograph below the button is held with the first two fingers of the left hand while the thumb and forefinger of the right hand pump a needle bar up and down The vertical needle bar automatically moves horizontally so that the needle will enter the eyes of the button in order A small clamp accessory furnished with the machine holds small buttons snaps and hooks and eyes that would be difficult to hold by hand



Button sewer n use Needle bar s worked by hand

New Conveniences



VEGETABLE CUTTER Potatoes and other veg etables are cut to var ous s zes and shapes by th s accesso y as a lever forces them aga nst interchangeable cutt ng blades set n e ther end

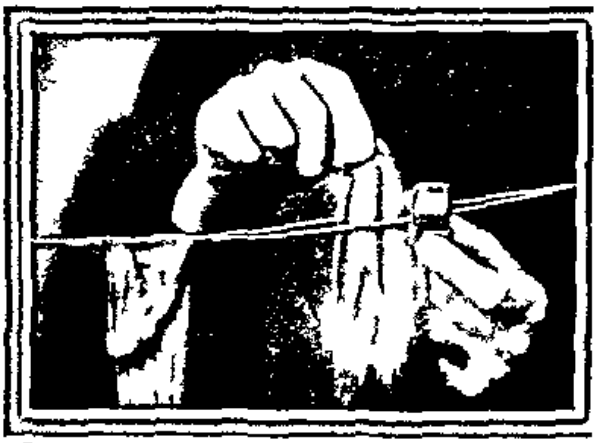
WEATHER FORECASTER

Changes n the weather are foretold by the ornamental ba ometer at the r ght It cons sts of a pear shaped glass globe w th a graduated nner tube The water level n the tube reflects changes n the atmosphe c pressure



METAL CLOTHESLINE

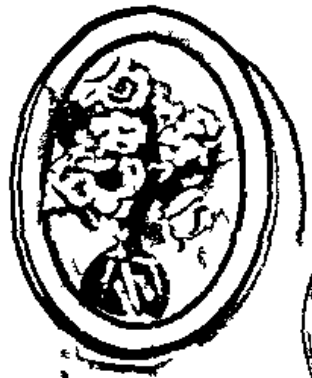
Two tw sted metal w res re place cord in the clothes l ne below No clothesp ns are used as garments are gr pped between the w res wh ch are separated for the purpose by sl d ng a pulley along the l ne Rustproof the w res w ll not stretch



VACUUM JUG HAS FAUCET

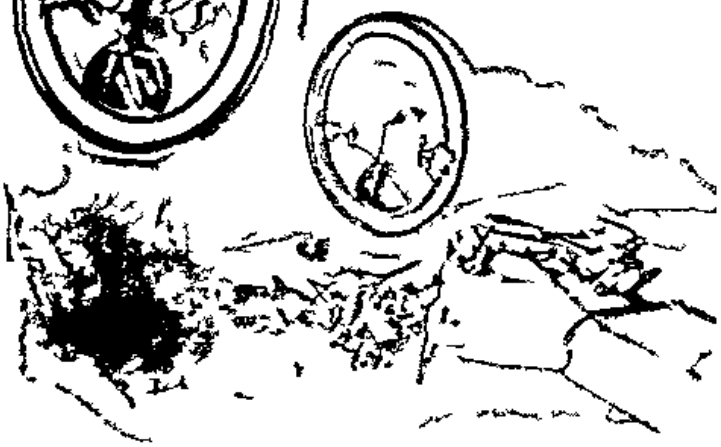
A pressure created by squeez ng a rubber bulb on the vacuum jug below forces l qu d from a spout



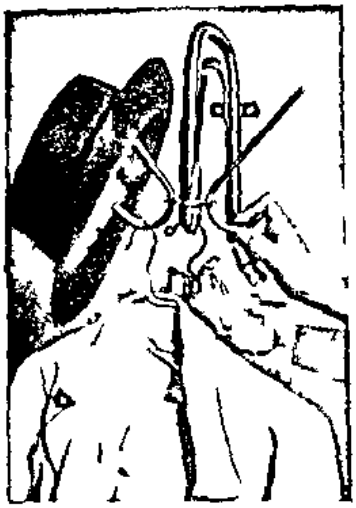


PICTURE FRAME VASE

P ctures of fresh flowers are made w th the novel vases shown mounted in ell pt cal f ames One k nd hangs on the wall and the other can be set on a table



for the Household



WALL CLOTHES TREE

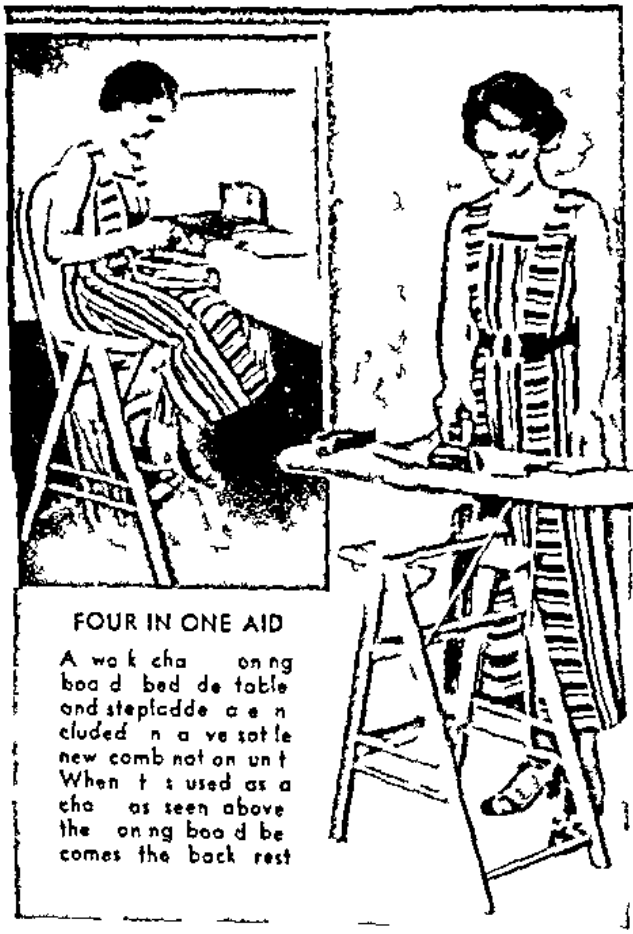
Fastened to a closet wall or door th s handy rack has all the advantages of a stand ng clothes t ee Its top ro tates for mo e conven ence

TWO WAY SHAKER D v ded nto two sect ons a new table accessory d s penses e ther salt or pep per Press ng a lever as shown below shuts off the salt and releases pepper





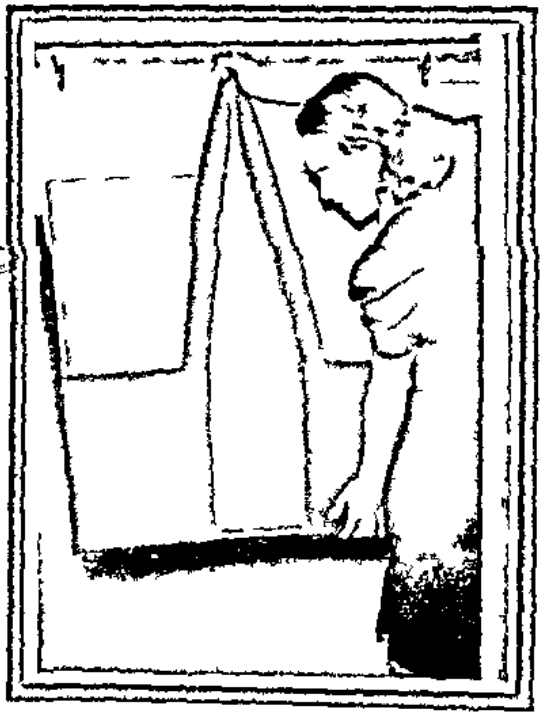
TRANSPARENT CAP Made f om a f anspc ent rubbe product a novel cap p otects the ha r da f om water n the shower It can also be u ed as a dust cap and for outdoo sports



FOUR IN ONE AID

A wo k cha on ng boa d bed de table and steplcdde a e n cluded n a ve sat le new comb nat on un t When t s used as a cha as seen above the on ng boa d be comes the back rest

BRIDGE TABLE SLING The p oblem of sto ng the br dge table between pa t es s solved by the sl ng shown below Made out of heavy den m t has pockets n wh ch co ners of the table f t for hang ng up n a closet





Th s p ant w ha e a good home wh le ts owne s away

Plants Are Boarded at Hothouse Hotel

A BOARDING HOUSE for house plants is now in operation in the suburbs of New York C ty so that householders planning to be away from home on business or vacation trips can leave their plants in safe hands The plant nursery fees range from twenty five cents a month for a geranium plant to ten dollars a month for a large tub-planted orange tree All rates are Amer can plan

Milk Is Kept Fresh by Novel Process

PRESERVING milk in hot weather without ice or refr geration is said to be made possible by a new proc ess Gases are first removed from the fluid and replaced with oxygen Then the milk is smothered with oxygen for several hours under pressure at from 104 to 176 de grees F Saturated w th oxygen in storage it is said to keep for sev eral weeks at room temperature

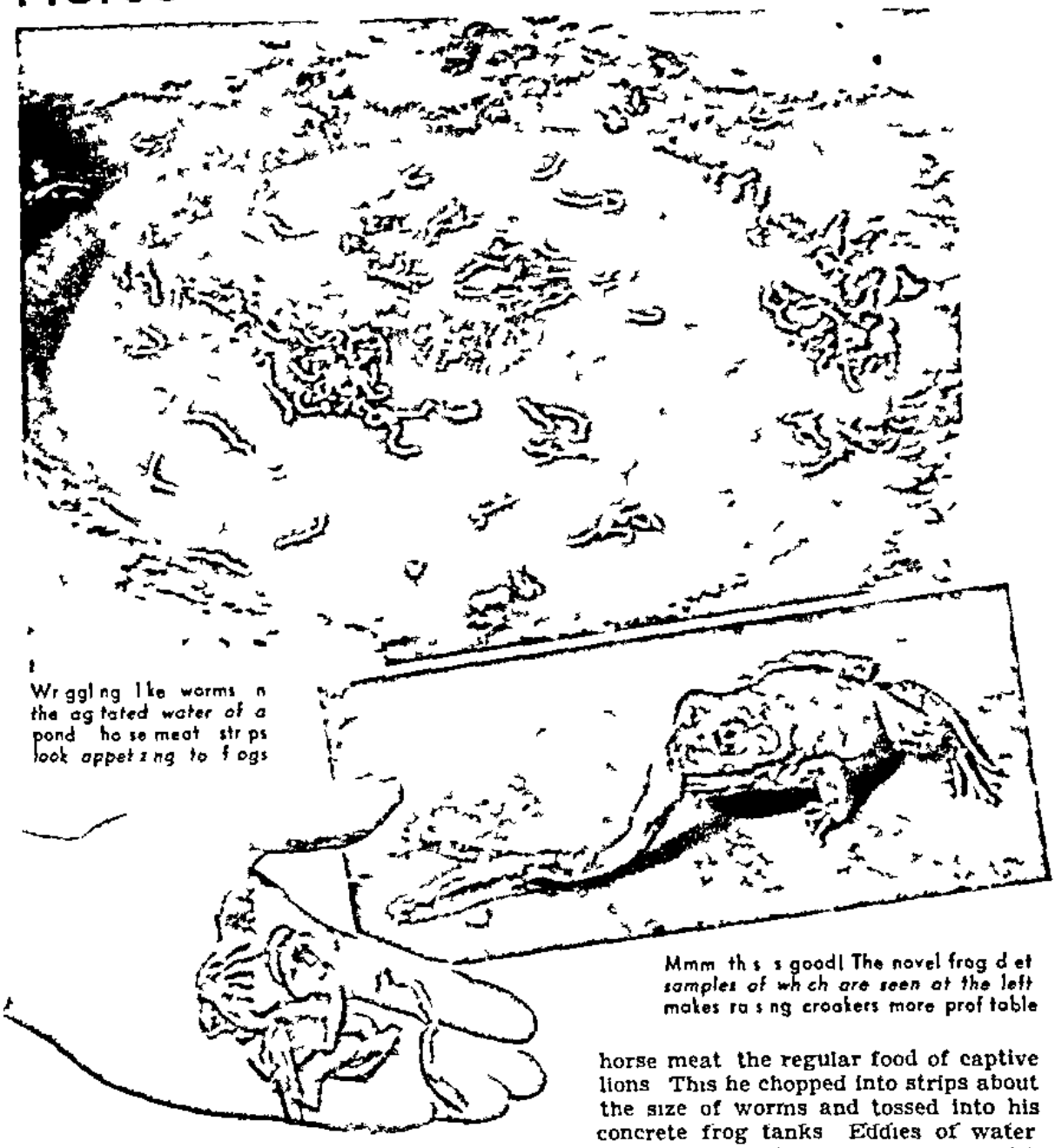
Model Homes Built with Ready-Made Kits

MODEL homes are bu lt easily with construction kits now available Var ous outfits for a large variety of house styles have parts ready to assemble although they are left unpainted to allow the owner to select his own color scheme Walls and roof are wood panels resembl ng s d ng and shingles while doors and win dows come in un ts ready to sl p into open ngs



Comple ed model hou e of ea ly Ame can de gn R ght pu ng a w ndow f ame n plo e

Horse-Meat "Worms" Fool Frogs



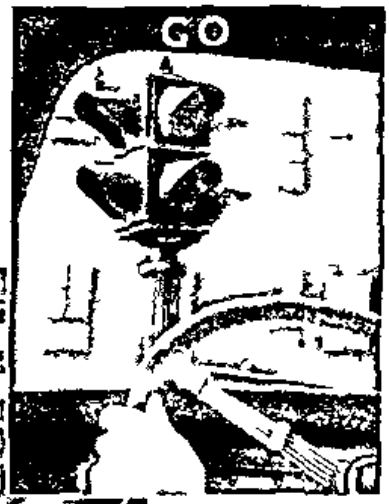
Wr ggl ng l ke worms n the ag tated water of a pond ho se meat str ps look appet z ng to f ogs

Mmm th s s good! The novel frog d et samples of wh ch are seen at the left makes ra s ng croakers more prof table

TRICKING frogs into eating horse meat by making them think it alive is the so lution worked out by H L Parker of El Monte Calif for the problem of diet in do mestic bullfrog breeding For twenty years Parker has been experimenting in raising frogs as a food delicacy Recently he de cided to try feeding his frogs on a horse meat menu since he found it practically im possible to provide the frogs natural live diet of vast quantities of minnows insects and earthworms He contracted with the owner of a near by lion farm for a supply of horse meat the regular food of captive lions This he chopped into strips about the size of worms and tossed into his concrete frog tanks Eddies of water created by a high pressure water jet from a pipe animated the meat strips and made them appear to swim about on the surface Frogs came hopping from all di rections and snapped up the morsels with relish Now Parker buys his own horses and has them butchered at a near by processing plant to provide food for his amphibian live stock Horse meat is fed to the frogs twice a week and they thrive on it so well that Parker figures in seven months he can make about $400 profit on an original $100 invest ment with a batch of 1 000 meat eating frogs raised for the market

Glasses Let Color-Blind See Red Light

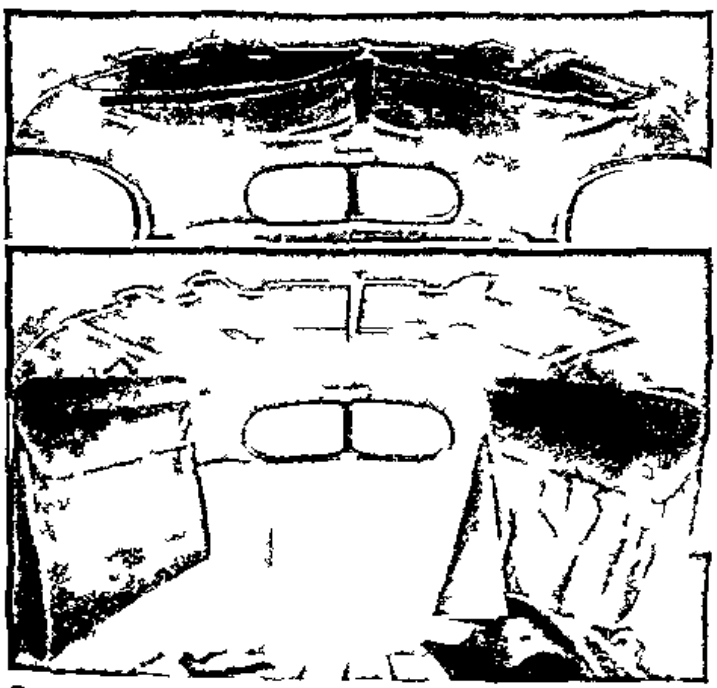






Through the spectacles of glasses a color blind driver sees light in the traffic standard only when the red or amber signal is shining

TO ENABLE color blind motorists to determine whether a traffic light is red or green a New York City optical firm has just introduced special glasses The spectacles are made in two sections the upper consisting of a segment of dark red filter glass and the lower of clear crown glass although optically ground eye correction lenses may be employed for those who ordinarily wear glasses when driving With the spectacles on the color blind driver looks through the red filter section of the lenses as he approaches a traffic light If he sees any light at all in the traffic standard he knows that it must be either red or amber the stop or caution signal since the filter blocks out all rays emanating from the green go-ahead light while admitting the others Since eye specialists estimate that one person in every twenty five is color blind the filter glasses should make an important contribution to the problem of increasing traffic safety



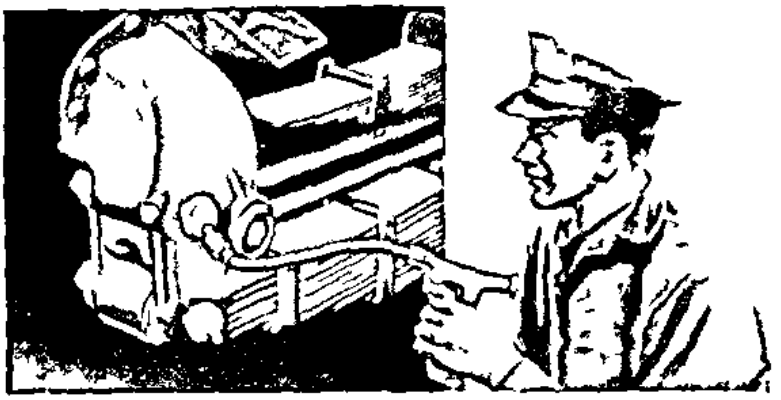
Garment bags open for inserting or removing suits In the upper picture they are strapped to the roof of the car for traveling

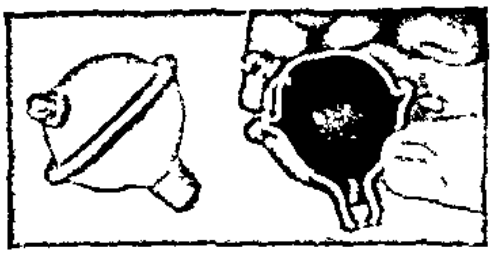
Car Travel Bags Strapped to Roof Out of the Way

GARMENT BAGS that fit out of the way flush against the ceiling of an automobile are a new convenience for tourists and travelers A wire framework fits snugly to the ceiling of the car extending across from the top of one side window to the other Two detachable garment bags made of imitation leather and fitted with hangers are suspended by a handle from each side of the wire frame When packed the bags are swung up into an overlapping position on the ceiling and held in place by straps and hooks as shown in the upper photograph at the left

Lubricator Feeds Grease Automatically

AUTOMATIC lubrication of springs, control arms, drag links, and other automobile bearing surfaces is accomplished by an ingenious fitting The simple unit is a small steel sphere, having a grease-gun fitting and designed for insertion into bearing holes directly, or indirectly through adapters A hollow synthetic rubber ball fills the interior until grease or oil forced into the sphere collapses the ball and compresses the air within it This compressed air tends to return the ball to its original round shape, a gradual process that pushes grease or oil into the bearing surface as the supply is used up Each sphere holds a quarter of a fluid ounce



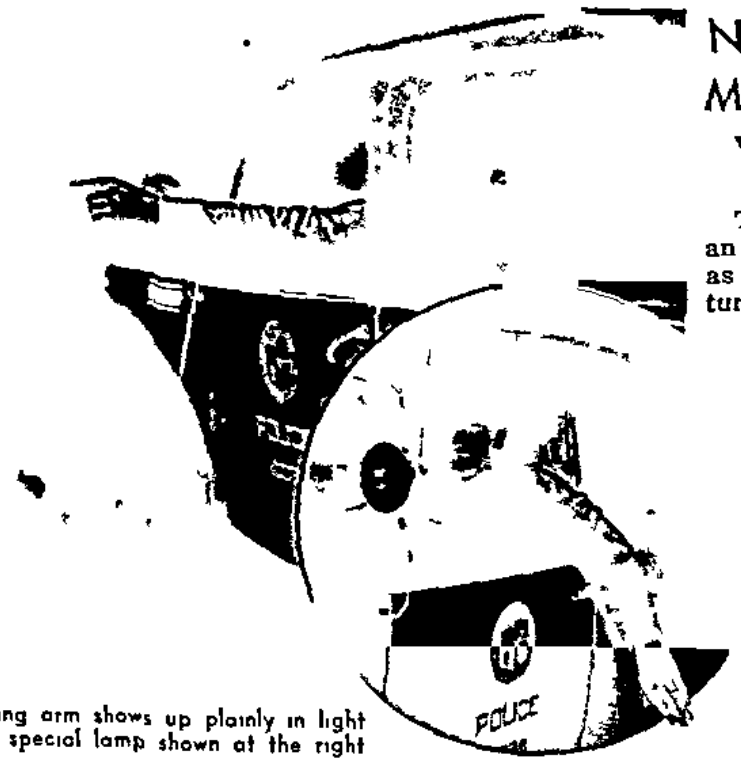


Pumping grease into lubricator A rubber ball, seen at left expands to feed it gradually to bearing surface



Blackjack Shifts Gears

MADE of soft rubber with a lead-weighted ball at one end the gearshift knob and shaft pictured at the left can be removed quickly for use as a weapon in case of a holdup or other emergency along the highway



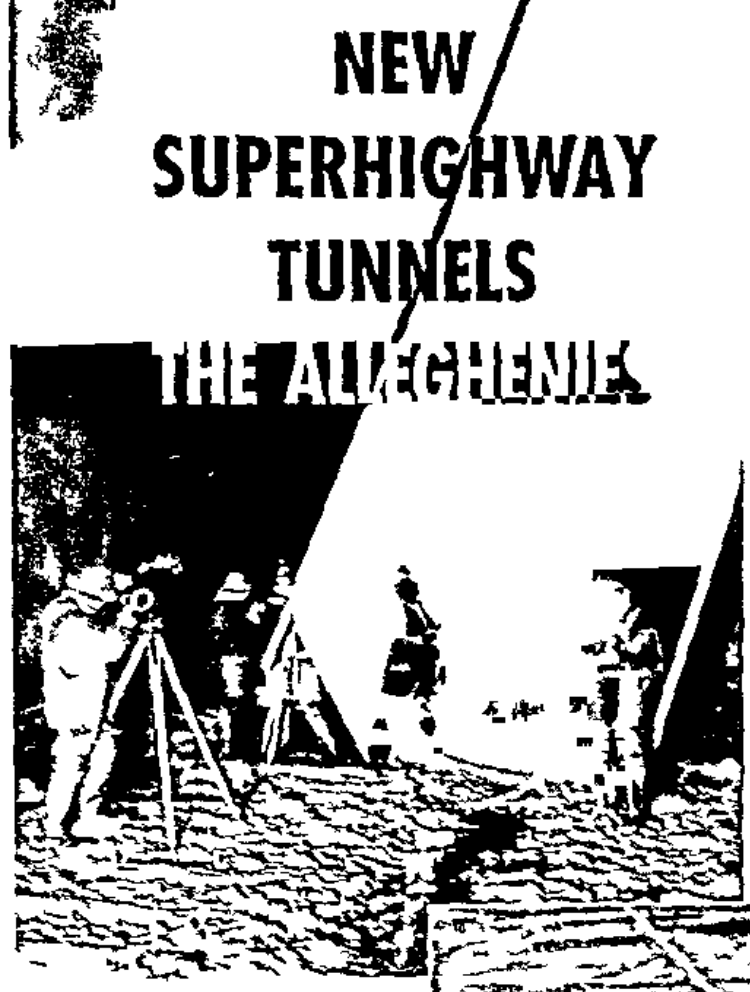
Signaling arm shows up plainly in light of the special lamp shown at the right

New Safety Light Makes Arm Signal Visible at Night

TO ILLUMINATE the arm of an automobile driver at night, as he extends it to signal a turn or stop, a Los Angeles, Calif, firm has just introduced a special safety light. Designed to fit within a car at the back of the driver s window, the safety light can be installed in any make of car within a few minutes. The accessory has been endorsed by the Los Angeles Police Department, which has installed a number of the lights in its radio-equipped patrol cars

NEW SUPERHIGHWAY TUNNELS THE ALLEGHENIES

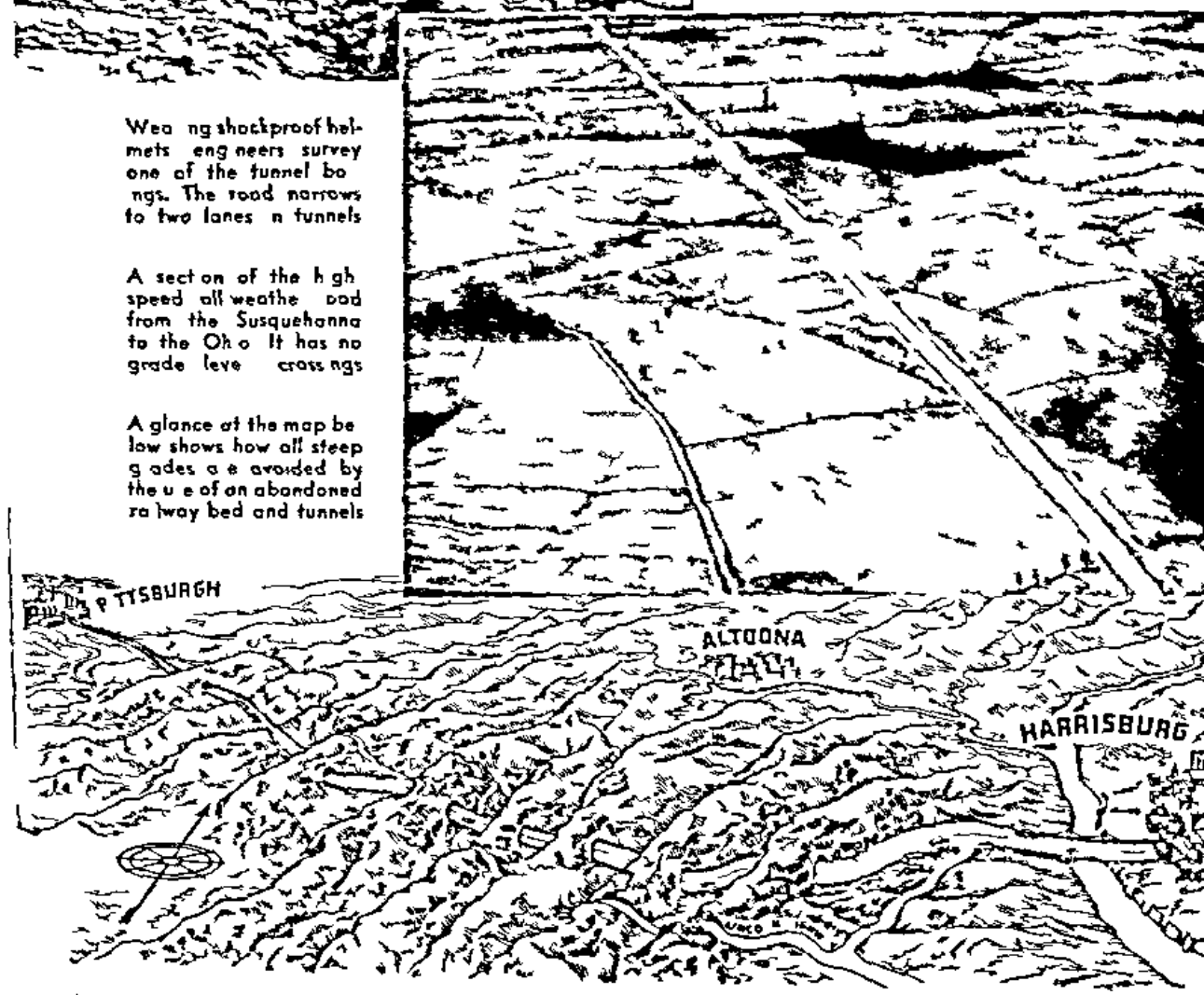
STRIKING directly through the Allegheny Mountains instead of over them, a new 160-mile superhighway between Pittsburgh and Harrisburg Pa., will be opened for the first time this summer Following the road bed of an abandoned railway the superhighway leads through seven miles of tunnels, mostly dug by the railroad builders. Workers wearing special rubber-cushioned helmets, upon which a ten pound rock could fall from a twenty five-foot height without causing injury completed the tunneling The borings help to keep all grades at a maximum of three percent, permitting high speed car and truck traffic over four concrete lanes. A motorist s dream, the highway has no cross streets, railroad crossings, towns, or traffic lights. Its construction reduces the total vertical climb in crossing the Alleghenies from 10 000 to less than 4 000 feet, materially reducing driving time fuel consumption, and danger in winter on icy grades, while greatly increasing driving ease and comfort for motorists. Its route, with relation to the present Lincoln Highway is shown in the map below

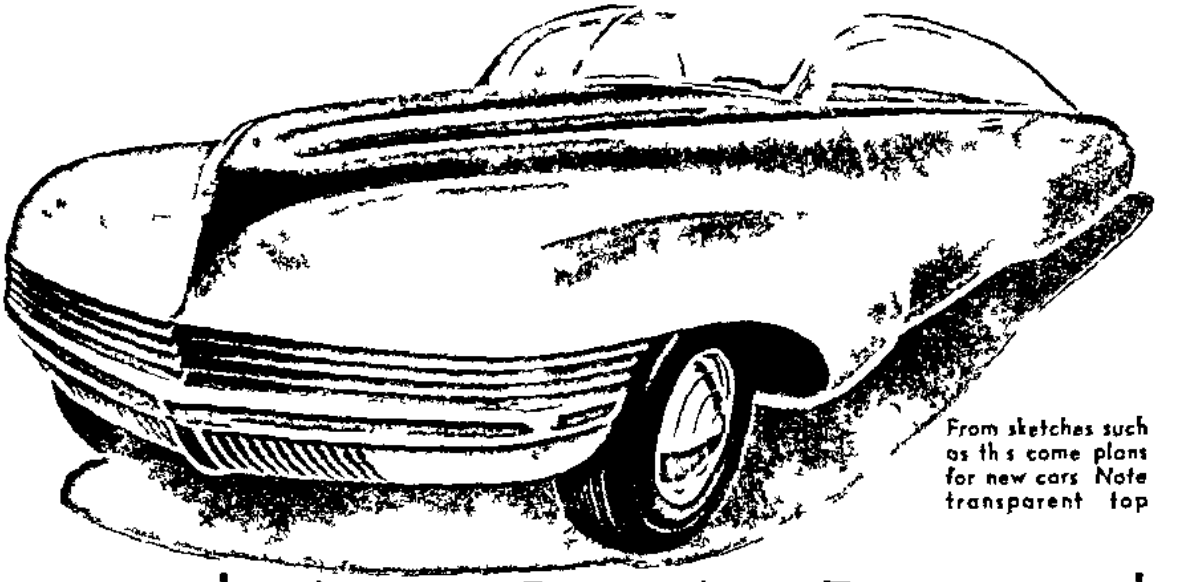


Wearing shockproof helmets engineers survey one of the tunnel borings. The road narrows to two lanes in tunnels

A section of the high speed all weather road from the Susquehanna to the Ohio It has no grade level crossings

A glance at the map below shows how all steep grades are avoided by the use of an abandoned railway bed and tunnels





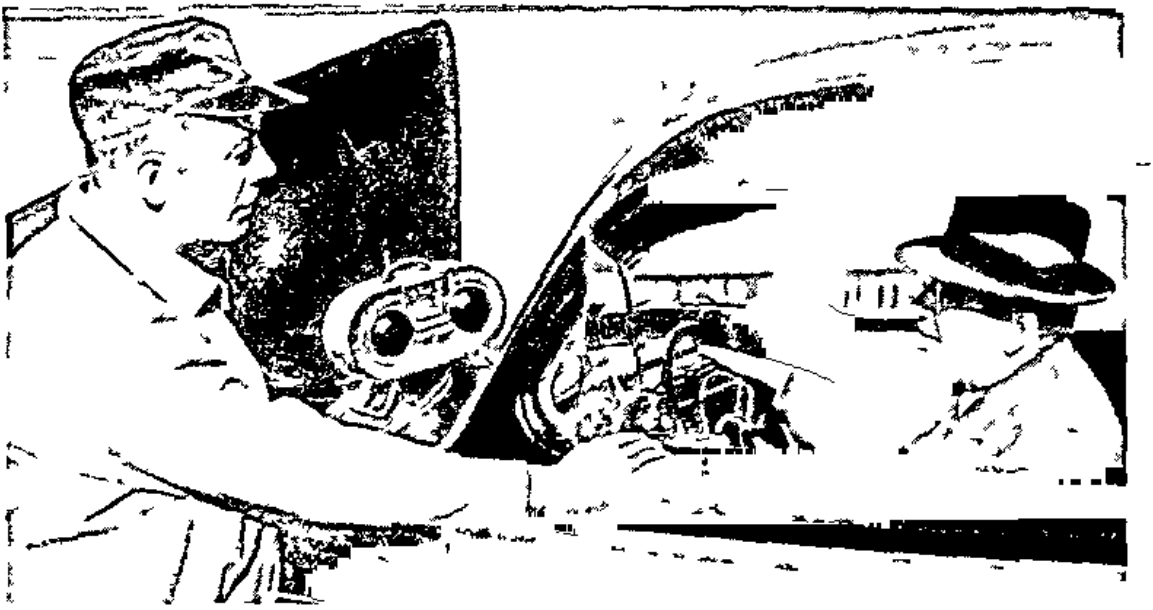
From sketches such as th s come plans for new cars Note transparent top

How the New Cars Are Designed

AN ARTIST sketches an exotic streamline design on a giant blackboard Sculptors model it full size in clay Artisans carve it out of solid chunks of wood Metalworkers fashion it in sheets of steel Finally a car of new and daring design is created only to be driven virtually to destruction in brutal tests that will decide whether it shall be scrapped or become the newest product of a mass production line In the accompanying photographs taken in the art department of the Chrysler Corporation in Detroit, Mich you see a few tentative models of the company s future cars There as in similar departments of other manufacturers the endless process of improving the appearance and performance of cars goes on behind locked doors to make your car of two or five years hence a reality

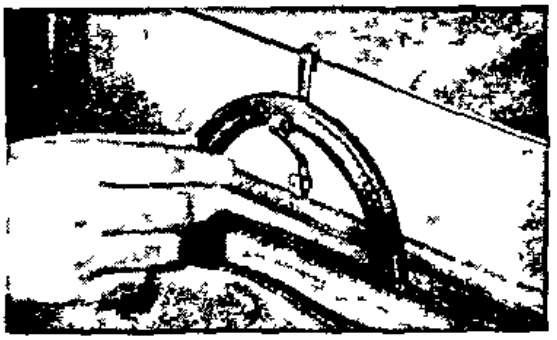


Des gn ng new dashboards R ght mak ng clay mock ups of fentat ve models



New Battery Tester Speeds Car Service

QUICK checking of the condition of car batteries without removing them from the car is possible with a new accessory for service station attendants Cables attached to the unit are readily clipped to one battery terminal and the car s ground As a motorist touches his starter button, visual indicators register the battery s condition



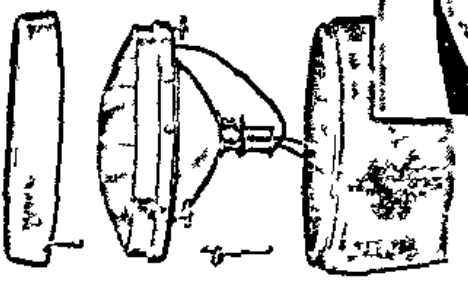
Rubber on th s hook prevents scratching the window

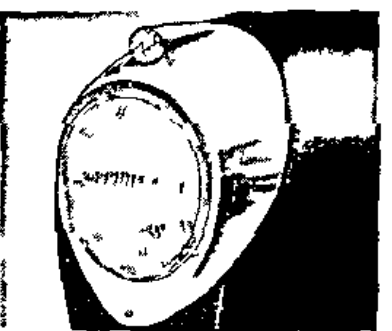
Rattleproof Coat Hooks for Auto Windows

WINDOW HOOKS for car doors that do not interfere with opening or closing the windows have just been put on the market Coat hangers, coats, and other articles hung on them are held securely in place Because the hooks are amply covered by rubber, there is no danger of their injuring the window glass under normal vibrations, according to the manufacturer In addition, they are effectively prevented from rattling

Sealed-Beam Conversion Kits

SEALED BEAM lights can now be installed on cars a year or more old with the parts contained in a new headlight conversion kit The change over is said to be extremely simple It merely is necessary to remove the rim, lens, and reflector from your present headlamp install the new parts contained in the kit, make several wiring connections, and replace the headlamp rim Adjustments are provided for aiming the lamps properly Two types of kits are available, adaptable to most standard makes of cars and trucks.

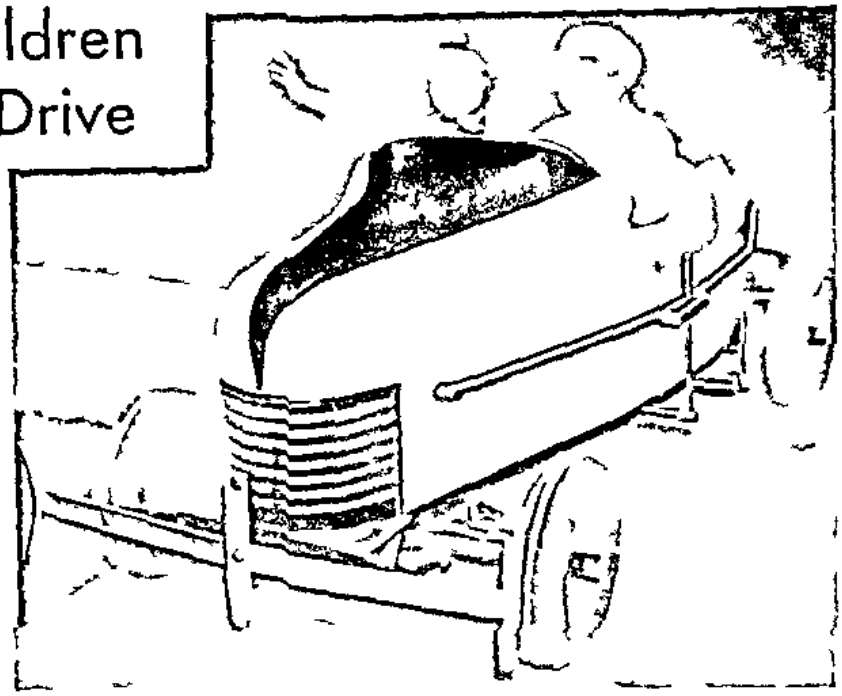




Parts like those shown above and at left fit sealed beam lights to the headlamps of your car in a few minutes

Car for Children Is Easy To Drive

DESIGNED and built by Karl Newhold of Roseville Mich an automobile for children has an all steel racing type body mounted on a sixty four inch wheel base The diminutive car is powered by a 2¹ horsepower gasoline engine that drives the midget at a top speed of twenty five miles an hour Simplified controls consist of a steering wheel and a combination lever that operates not only the starter but the brakes and clutch as well



Out for a spin in the kiddie car It can do twenty five miles an hour

Three Map-Reading Aids for Tourists



THREE new aids to help motorists follow their touring routes easily have just reached the market Shown at the top left is a map case with transparent pockets on the front and the back for maps in immediate use plus three pockets for extra maps and pencil holding loops Below this is pictured another map case in which any map six and a half inches wide and under twenty five feet long may be mounted on rollers and turned by knobs to bring a desired section into view below the transparent cover The third item is a key chain and ring fitted with an unbreakable plastic magnifying glass to simplify the task of examining road maps in detail



At top is a map case with transparent side pockets Above another case in which strip maps move on rollers under a window Right key chain with unbreakable magnifying lens

CAR TIPS FOR



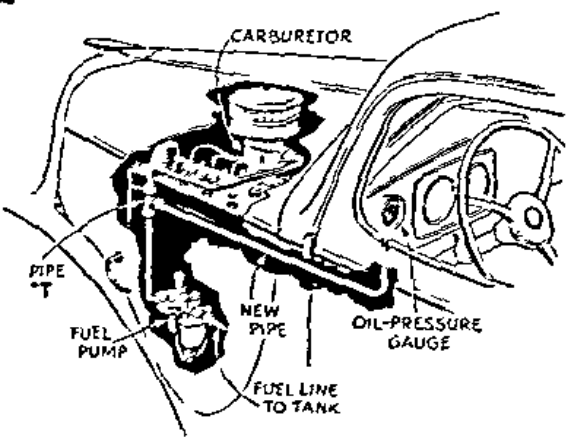
Other cars lights illuminate the reflector

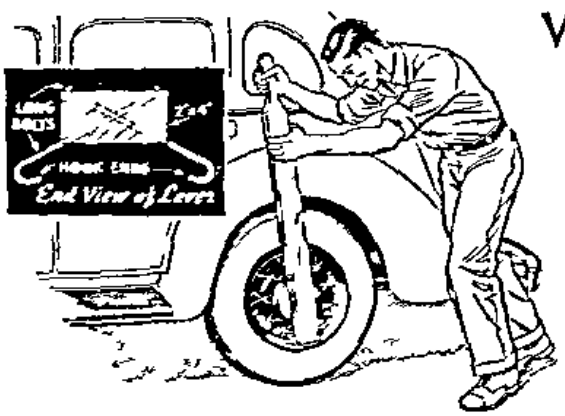
Reflector Button Inside Door Protects Motorist

FOR car repairs beside the road at night, it is a good safety measure to have a red reflector button fastened permanently on the inside of the left front door, or of either left door hinged at its front edge as indicated in the accompanying sketch. If your doors are hinged at their rear edges have a button on hand that can be hung on a door handle when needed Motorists coming from behind when the door is open will see the reflector and be warned in time to give you and your car a wide berth.—R. H. P

Easily Made Gauge Tells Fuel-Pump Condition

A GASOLINE PRESSURE gauge to show that your fuel pump is working can be made from a length of copper tubing, a pipe T, and an old low pressure oil gauge The T is inserted in the line between the pump and the carburetor, and a new line run to the gauge mounted on the dash. For rubber mounted engines insert a flexible pipe to absorb vibration —R. McC

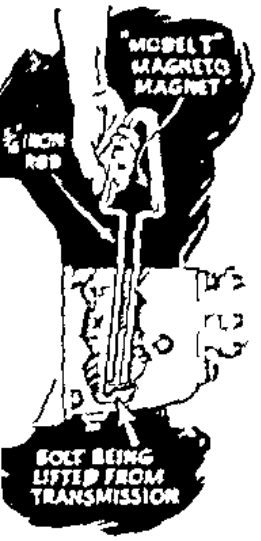




Wheel Lever Aids Moving of Cars in Garage

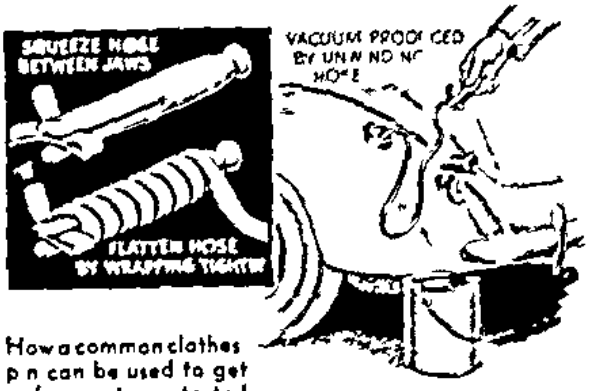
TWO long bolts inserted in a four foot length of two-by-four as shown at the left and hooked over at their ends provide a highly useful wheel lever for moving cars about in a garage In use the hooks are inserted in the spokes or slots of a rear wheel, and the handle pushed in the direction it is desired to move the car One man can thus move a car easily Rubber tubing pushed over the bolts will prevent marring the wheel finish.—E. H.

AMATEUR MECHANICS



Long Magnet Recovers Dropped Parts

MANY mechanics have had the time wasting experience of losing a key washer or nut in a transmission box or other out of the way place in a car A long reach magnet will get them out in a hurry I made one from an old Model T magneto magnet around which I shaped a length of 5 16 iron rod as shown leaving parallel extensions about a foot long and an inch apart The assembly should be seasoned for about twenty four hours before attempting to use it to become thoroughly magnetized —P S



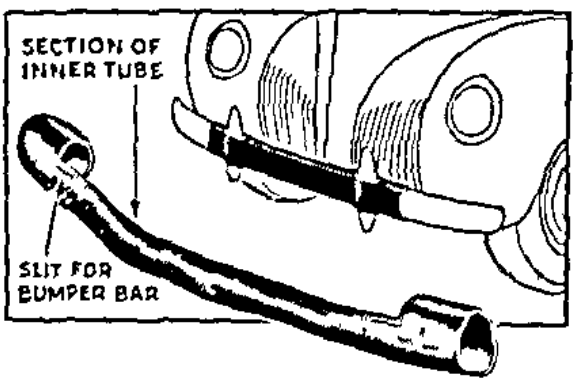
How a common clothes pin can be used to get siphon action started

Clothespin Starts Siphon

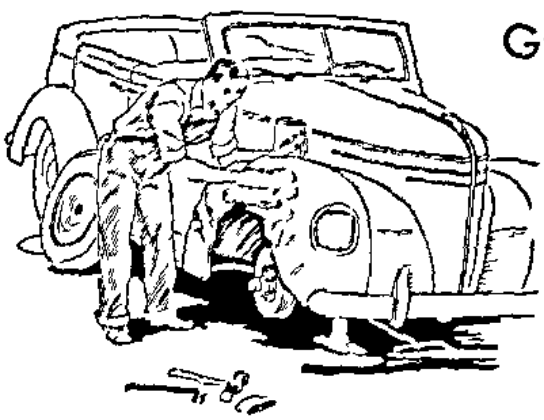
YOU can use a clothespin to start siphoning gasoline from a car tank avoiding the danger of sucking poisonous chemicals into your mouth Pinch one end of a rubber tube between the jaws of the pin and wrap the tube tightly over the whole pin Place the other end in the liquid and unwind the tube It will quickly fill with gas —L. W

Rubber Bumper Protector Is Old Inner Tube

BY CUTTING a length of old inner tube in the manner shown in the illustration at the right you can make an effective bumper protector for your car Folded and stored under or beside the spare wheel in your luggage trunk it will always be available for slipping on the bumper when you are called on to push a friend's car with your own You will find that it will protect the finish of both your bumper and his from ugly scratches.—E. H



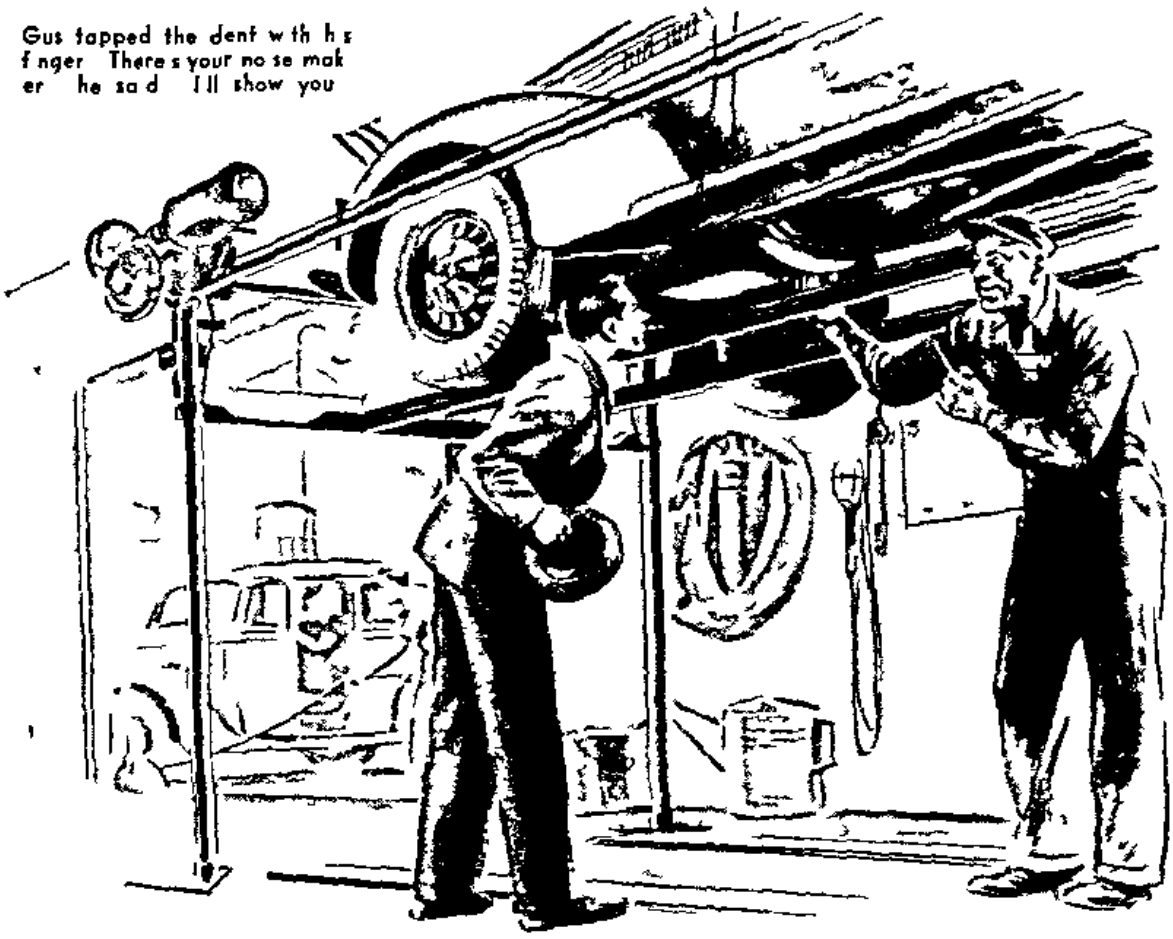
This pattern will make a guard for most car bumpers



Greasing the surface to keep paint from chipping off

Grease Saves Fender Finish

WHENEVER I have to straighten out a banged up fender that is not too badly mashed particularly where the finish has not been chipped when the damage was done I smear heavy cup grease on the outside of the fender Then I go to work and hammer the metal back in shape in the usual way I have found that when the fender is not too sharply dented a refinishing job is seldom necessary after the greasing precaution has been taken as the enamel is kept from cracking away from the metal by the heavy-bodied material —D M



Gus tapped the dent w th h s f nger There s your no se mak er he sa d I ll show you

Gus Listens, Then Looks

THE tan colored roadster on the Model Garage s greasing rack was five years old and it wasn t of an expensive make but Gus Wilson nodded satisfaction when he looked at it. Then he turned to the brisk looking young man who had brought the job in.

That s the way I like to see a car kept, he observed. Shows that its owner has had sense enough to learn something about the machine he s driving and that he isn t afraid of getting a little oil and grease on his hands Without even stepping on the starter I m willing to bet you get good mileage out of the gas you burn and that your engine does its job without making a lot of noise about it

The young man laughed bitterly You d win on the gas end of your bet, he said, but you d lose on the noise end. That engine *does* make a noise—a queer sort of noise that I ve spent a lot of hours and quite a few dollars trying to kill. But I ve never been able to even locate it let alone kill it. It s annoying but it doesn t affect the car s performance

That so? Gus said immediately interested. How come?

I bought the bus when it was three years old, and had about thirty thousand on its clock. I had new piston rings installed spent several evenings getting everything else in first class condition and then started off on a two week vacation trip The first hundred miles or so were swell—no trouble at all. Then I began to hear that noise—a light tapping It sounded to me like a valve stem chattering in its guide or maybe a broken ring I got out and looked things over as thoroughly as I could on the road but didn t find anything wrong So I went on. So did the noise! But the car continued to run all right.

That evening I checked things more thoroughly but I couldn t find a thing wrong Next morning it was the same as

When It Comes to Curing Car Ills You Can Save Your Hands by Using Your Ears and Eyes

• • •

By MARTIN BUNN

it had been the day be fore—not a sound for a couple of hours and then that tapping again It was like that every day for two weeks and it darned near ruined my vacation

As soon as I got home I had the car gone over by the people who had installed the new rings They said that the noise was caused by the push rods which were worn and should be replaced So I had them put in new push rods Same thing all over again—I d start out all right but after I d been driv ing a couple of hours the tapping would start

Since then I ve had the car in a dozen shops but no one has been able to find the cause of that noise Now I ve given up looking for it. But at that it still bothers me

Sure—it would Gus sympathized You never hear it until you ve been driving a couple of hours hey? That looks as if—

He broke off went over to the car walked under the greasing rack and ran a fore finger over a small dent in the lower fly wheel cover That s been there ever since before I bought the bus the owner told him The first fellow who had her must have dented it driving in a deep rut—or maybe a heavy rock hit the cover

Gus nodded. 'That noise you were telling me about he said Is it any louder when you re doing fifty than it is when you re going about thirty?

Not much louder the young man said But the taps seem to be a lot faster when I m going fast At fifty the noise sounds continuous

Gus tapped the dent with his finger 'There s your noise maker he said I ll show you Hey Harry get that lower flywheel cover off will you?

His helper took the cover off Gus examined its inside surface carefully Then he pointed to a small burr on which the metal was polished bright by friction

There it is he said A tooth on the flywheel starter ring that s maybe only a couple of thousandths of an inch higher than the others just barely touches that burr on every revolution of the wheel I suspected something like that when you told me that the taps are closer together when you are go ing fast than they are when you are going slow A noise like that always is hard to locate—it gets magnified and by the time it gets out to you it might be coming from anywhere in the engine Want me to fix it? Flattening out the burr and putting a little weld in the cover will do the trick

There s something I don t understand the young man hesitated Why is it that I never hear the noise until I ve driven a hundred miles or so?

Expansion Gus told him 'That burr isn t high enough for that high tooth to hit it while the engine is fairly cool But after a couple of hours of driving the engine gets good and hot. That causes the metal of the flywheel to expand—and that makes the high tooth hit the burr

The roadster s owner still looked doubtful I know—you ve been stuck before on this job Gus said This time you needn t take a chance If you ever hear that noise again drive in here and I ll give you back your money

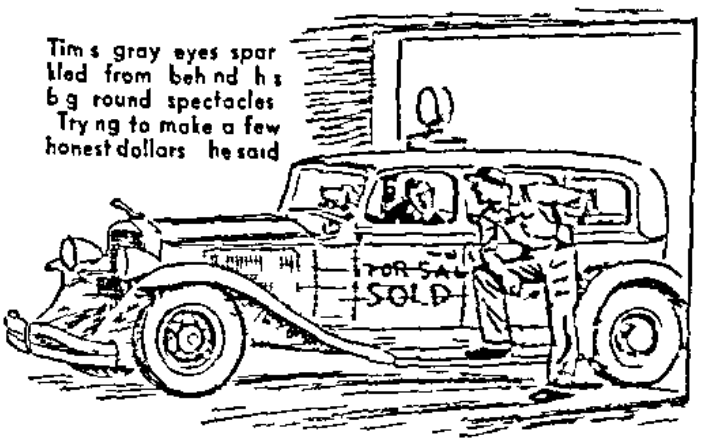
Go ahead and fix it the young man said

An hour later tousle headed young Tim Sheridan his dog Dodger on the seat beside him drove into the shop in a sedan of 32 vintage and disreputable appearance

What the heck are you up to now? Gus greeted his favorite disciple

Tim s gray eyes sparkled from behind his big round spectacles Trying to make a few honest dollars he said I bought this old wreck for fifty and I ve dug up a guy who ll give me a hundred for it—*if* I can make it run right. That fifty-dollar profit is exactly how much more I need to get me through my first year at Tech

That close? Good for you' There was appreciation in Gus s voice He knows how



Tim s gray eyes spar kled from beh nd h s b g round spectacles Try ng to make a few honest dollars he said

hard Tim has worked getting together the stake which will put him on the road to being able to sign M E after his name Well what s the matter with the bus—senile decay?

I don t know what s the matter with it Tim admitted. What *was* the matter with it was that it was so full of carbon that it knocked whenever it tried to climb a hill I ve scraped the carbon out and ground the valves But now it dies on me whenever I speed up the engine It ll keep going after a fashion with the choke all the way out but when I put it in —dead

Carburetor all right? Gus asked

Yes I cleaned it and adjusted it Gas line too

How about the valve clearances?

Exactly what the book calls for

Then it may be the fuel pump Gus suggested

That s what *I* thought. But it isn t the fuel pump I put in new diaphragms Didn t do any good

Yes? Gus said Let s have a look

He examined the pump and carburetor Start your engine and let it idle he told Tim The engine idled smoothly enough Huh Gus grunted. Now speed her up Almost at once the accelerated engine stopped

Gus felt the nut where the gas line connected with the pump to make sure it was tight What s this? he demanded He held up his hand his thumb and forefinger were covered with some sticky substance

Shellac Tim said I put some around the line nut to make sure it wouldn t leak

You did hey? Gus grumbled Deftly he dismantled the fuel pump Then he carefully examined the check valve Take a look at this See? The valve is gummed to its seat Some of your shellac worked back into the valve seat Clean it out thoroughly and put in a new check valve

Tim examined the valve intently You re right—as usual he admitted The valve s stuck sort of half way—open enough to let sufficient gas flow through to keep the engine idling but not enough to keep it running when you step on it

It was quitting time and Gus began to wash up Tim perched on the workbench and rolled a cigarette You re a good guy Gus he said I sure do need that fifty dollars and now I ll get it

Forget it Gus growled Anyhow I like trouble shooting Keeps the old bean in working order Did I ever tell you about the hardest trouble shooting job I ever ran up against? It was four or five years ago An ice cream company down in the city bought a fleet of sedan delivery cars and outfitted them with dry ice refrigerators Before long they began to find the cars transmissions dry when they inspected them and the grease in the differential housing instead of where it belonged The manufacturer s service man told them to pack the rear bearing lock ring slots with ground cork —but that didn t do any good and neither did anything else that they tried

The fellow who has charge of their garage is an old pal of mine and when his boss began giving him real hell he called me up and asked me to go down and see if I could find the trouble They were having exactly the same grief with all their cars so I worked on only one of them I took its transmission down and checked every part —O K. I checked the alignment with the rear end—O K I did everything I could think of and every night the car came in with its transmission almost dry and the grease in the differential housing

I began to lose sleep over the job—and I hate to lose sleep One day I got down to their garage just as the car I had been working on was driven in I got under it and as I took out the plug to check the grease I heard a peculiar sort of hissing sound That was the tip off Without saying anything to anyone I took a small electric hand drill and drilled a very small hole in the torque tube

I was waiting when the car came in the next day and I got under it in a hurry The grease was all in the transmission where it belonged and I knew I had the trouble licked

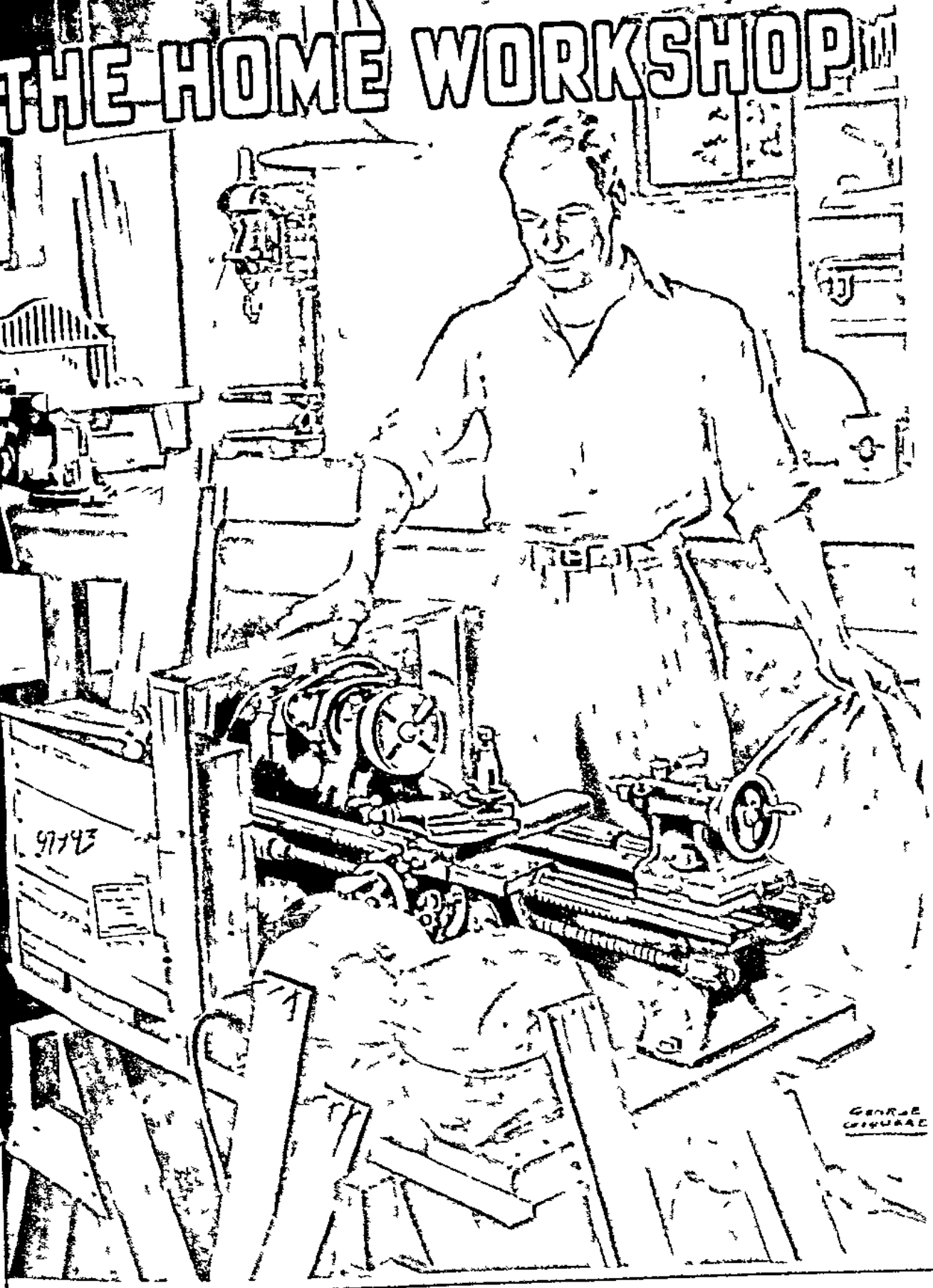
All right Tim said I ll bite What *was* the trouble?

Gus grinned The ring and pinion gears created a suction which pulled the grease down the torque tube into the differential he explained The hole I drilled killed the suction In the next year s model the makers vented all their torque tubes. One of those little things—easy to fix, but the hardest trouble shooting job I ve ever been up against.

GUS SAYS·

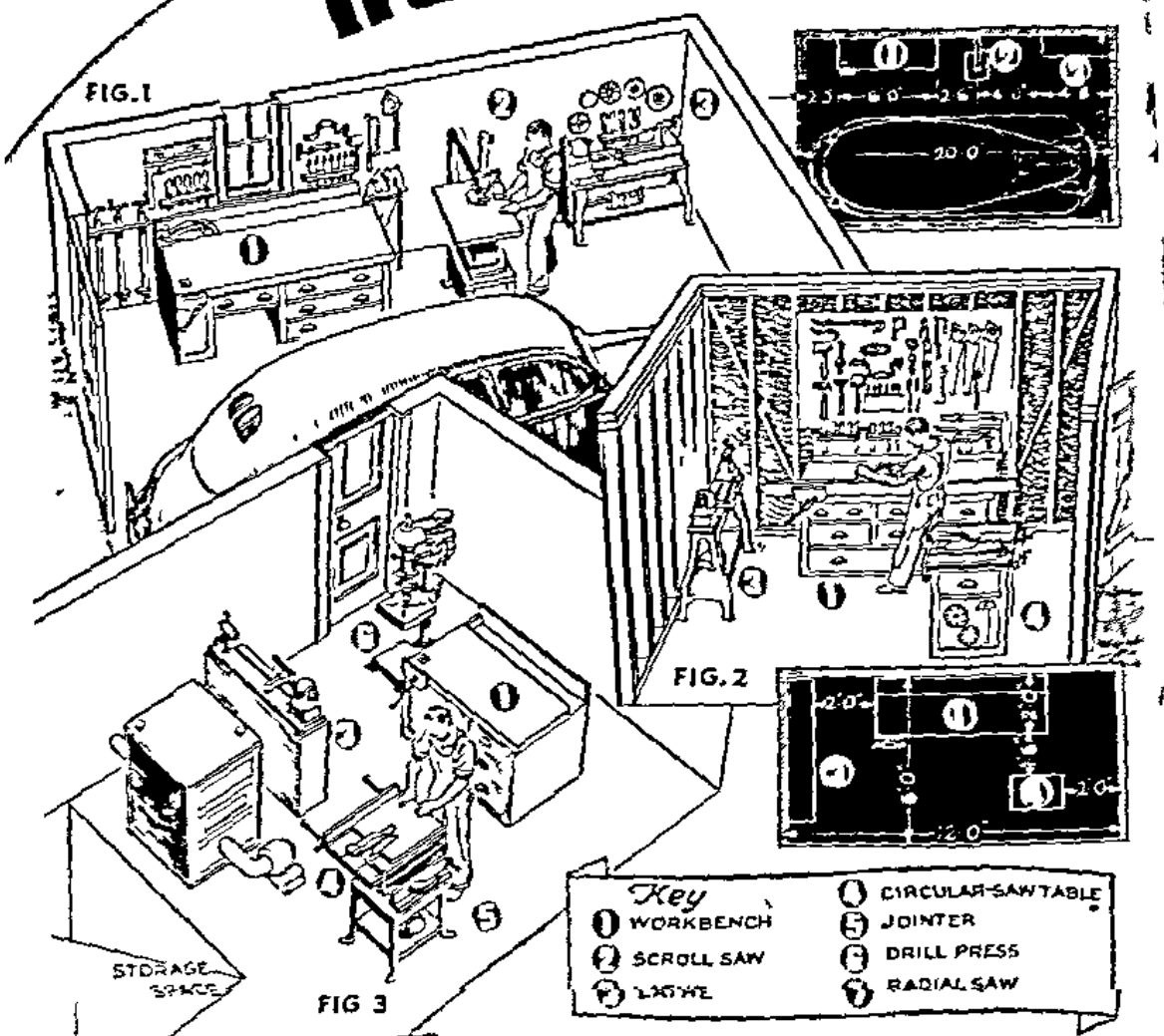
Somebody tried to tell me that car headlights are too bright nowadays That s as foolish as saying modern gas is too strong cars too fast roads too good Remember this They re all just as safe or dangerous as the car drivers that use them!

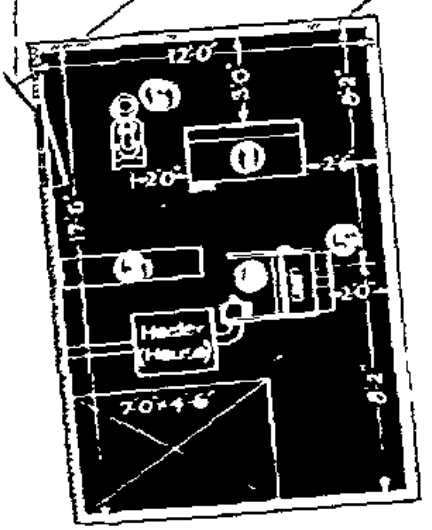
THE HOME WORKSHOP



In This Issue... SHOP LAYOUTS • DIVING GOGGLES
ACTION PHOTOS • BOOMERANGS • PAINTING

How to Lay Out



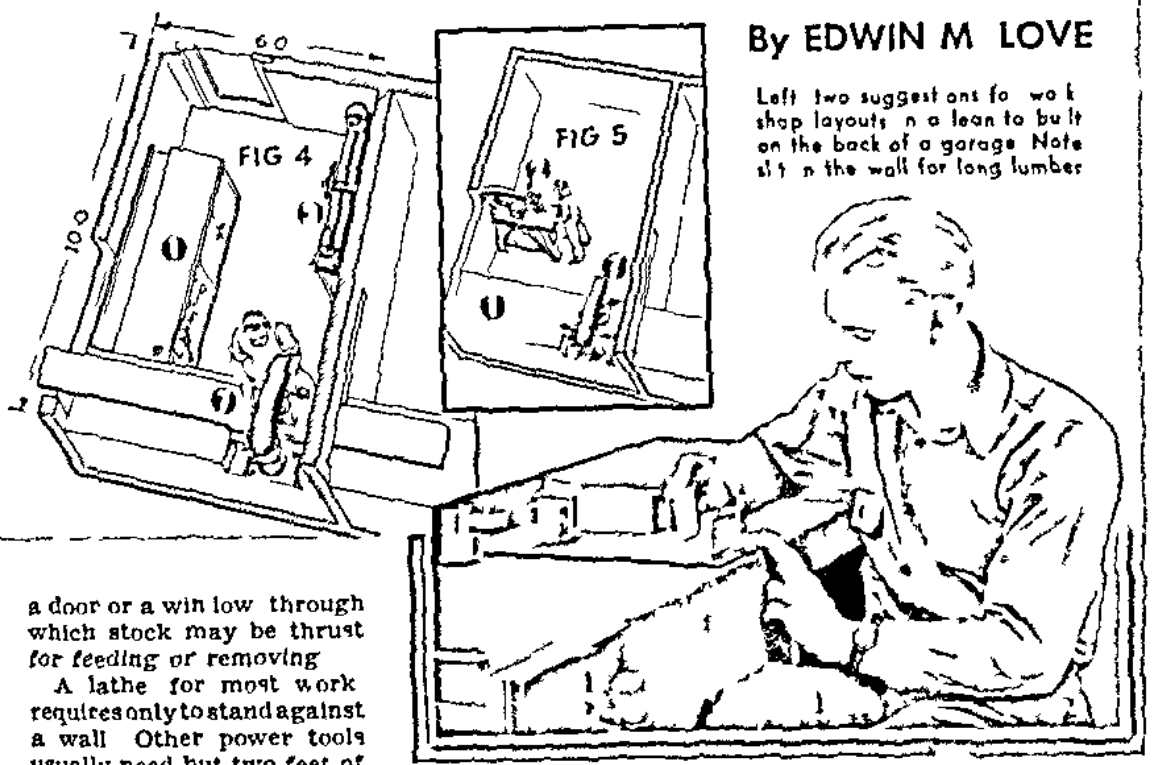


LIKE Robinson Crusoe on his lonely island, one machine in a shop is a law unto itself. If it is a circular saw, for instance, it may be the center for all other equipment. But let a shaper or a band saw be added, and the situation is changed, for machines, like men, have personality. Each prefers a certain task, each works best in its proper surroundings and with suitable companionship.

A jointer or a circular saw, to handle long pieces of lumber, demands a large working clearance in front or behind. A large room, of course, satisfies this need. In the usual small home shop, however, this space must be found by passing lengthy boards over benches and low machines, or by locating the machine near

Your Home Workshop

By EDWIN M LOVE



Left two suggest ons fo wo k shop layouts n a lean to bu lt on the back of a garage Note sl t n the wall for long lumber

The best way to plan your shop s to make rough models of the ma ch nes and move them about on a scaled layout of the floor space

a door or a win low through which stock may be thrust for feeding or removing

A lathe for most work requires only to stand against a wall Other power tools usually need but two feet of space in front and at the sides It is evident there fore that the placing of a machine depends not only on accessibility but also on the size and shape of the room the other machines and the type of work to be done

The personality of the user also must be considered The most convenient placing of equipment is often not the neatest and if the owner is bothered by a lack of order and is oppressed by the feeling of restriction occasioned by irregular spotting of ma chines he may find it best to arrange them according to appearance rather than their most efficient use

This article suggests several arrange ments for small shops equipped with from two to four individually driven woodwork ing machines There is also a diagram of a fully equipped shop such as a home work shop club might own It must be empha sized that these are only suggestions in tended to help in placing accessories to the best advantage in the room the owner has available Later articles will deal not only with the groupings of several machines but also the use of line shafts gasoline engine drives and special model making layouts

These diagrams show no cab nets Shouldn t they be considered in a shop plan?

It is the writer s conviction as a result of much experience that most accessories and hardware materials can be stored in cabi nets under the machines and benches and hand tools and lumber placed in racks on the wall or in hanging cupboards Floor space is precious so why build skeleton benches and mount machines on open stands and then build floor cabinets to clutter up the room? Arrange the machines first and adapt storage space to them Cabinets and similar equipment will be fully considered in later articles

Could a shop be started in a single garage?

If the garage is 12 by 20 as many are it is possible to obtain a working space about 5 wide by driving the car close to one side This is rather narrow and limits the number and kind of machines that can be chosen but it is much better than nothing

Considering everything the layout sug gested in Fig 1 is quite satisfactory The

bench indicated is 6 long with cupboard room inside and a good working space at the vise end With the scroll saw adjusted for cutting from the side not only can small lumber be handled but long decorative bands or cut outs as well

The lathe is chosen because turning can not be done by hand or even imitated without prohibitive labor If outboard turning is to be done the machine is easily swiveled to a diagonal position

How can end space in the garage be utilized?

Figure 2 is a good plan for a shop at the end of the garage If a side door is present or can be cut in set the circular saw near it where long boards can be fed in The saw if equipped with rollers can be pushed back at the end of the bench if the car encroaches In this shop moldings on straight work and outside curves are possible but sawed curves and fretwork must be done by hand

Must benches and machines other than the circular saw be placed against the walls?

No Some of the best arrangements come from putting the ends to the wall or even by standing equipment entirely out in the room as in Fig 3 This plan is excellent for irregular layouts as in a basement Notice that the drill press lathe and circular saw are within a radius of about 3 from the bench vise A scroll saw could stand along the back of the bench within the same circle All machines are within a couple of steps from the bench

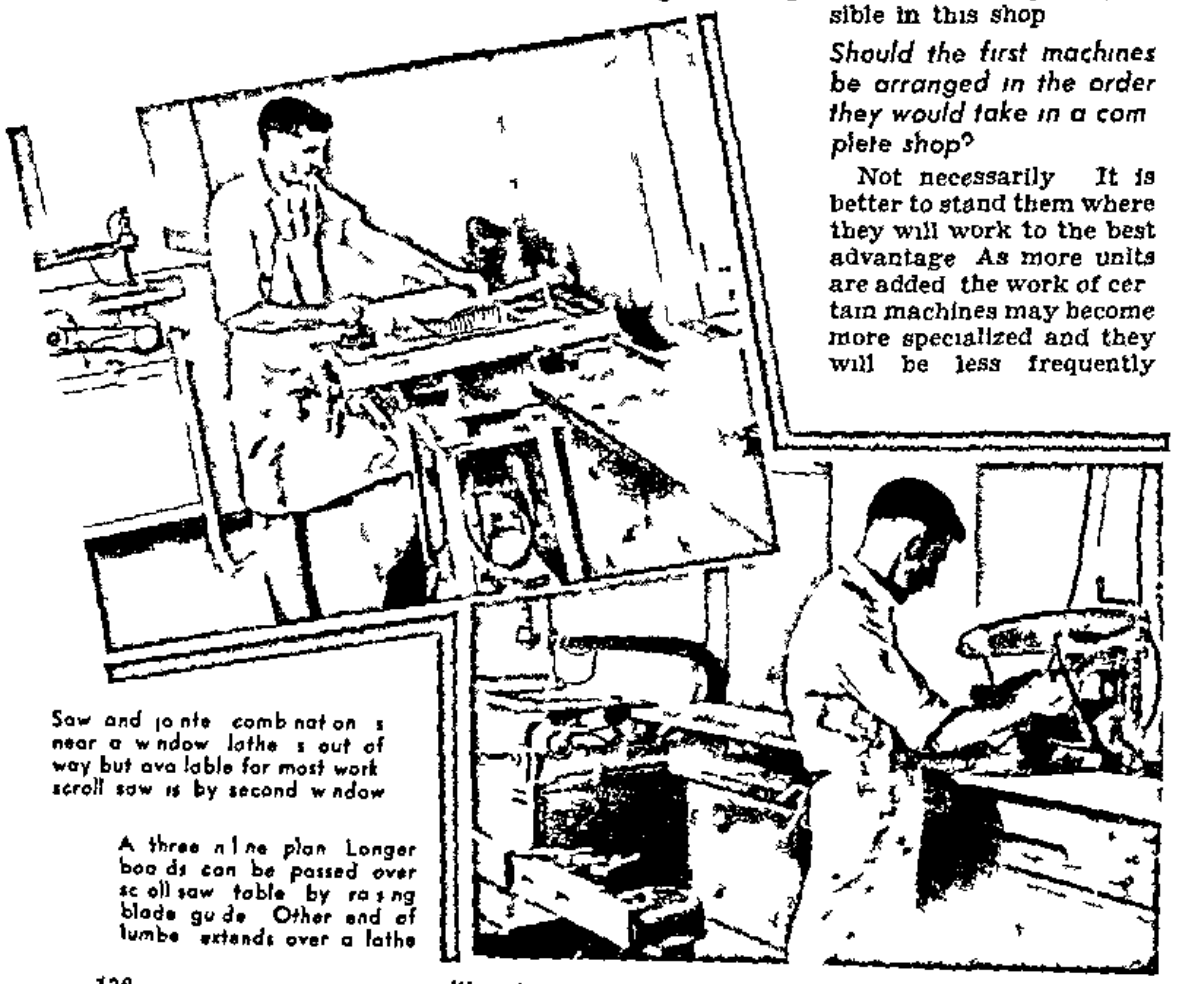
How may a small lean to or other addition to a garage be made into a shop?

The plans in Figs 1 and 2 would fit Figure 4 is an ingenious arrangement for an addition built on the end of a garage 10 wide Although the room is but 6 wide long boards can be crosscut or ripped by the use of a circular saw of the overhead track variety mounted on a bench at one end A slit in the garage end and a large window opposite will allow stock up to 4 wide to pass A supporting bench is built in the garage

In Fig 5 the bench and lathe are replaced with a scroll saw the saw bench serving as a workbench and cabinet Machine crosscutting and ripping jointing shaping disk sanding grinding scroll sawing edge filing die filing and metal sawing are possible in this shop

Should the first machines be arranged in the order they would take in a complete shop?

Not necessarily It is better to stand them where they will work to the best advantage As more units are added the work of certain machines may become more specialized and they will be less frequently



Saw and jointer combination near window lathe out of way but available for most work scroll saw is by second window

A three quarter plan Longer boards can be passed over scroll saw table by raising blade guide Other end of lumber extends over a lathe

used so it may be better to shift them to a less desirable position Nevertheless the arrangement of the complete shop should be planned at the start so that windows doors and electrical outlets can be intelligently placed for that purpose Minor deviations in the original plan can always be made if necessary

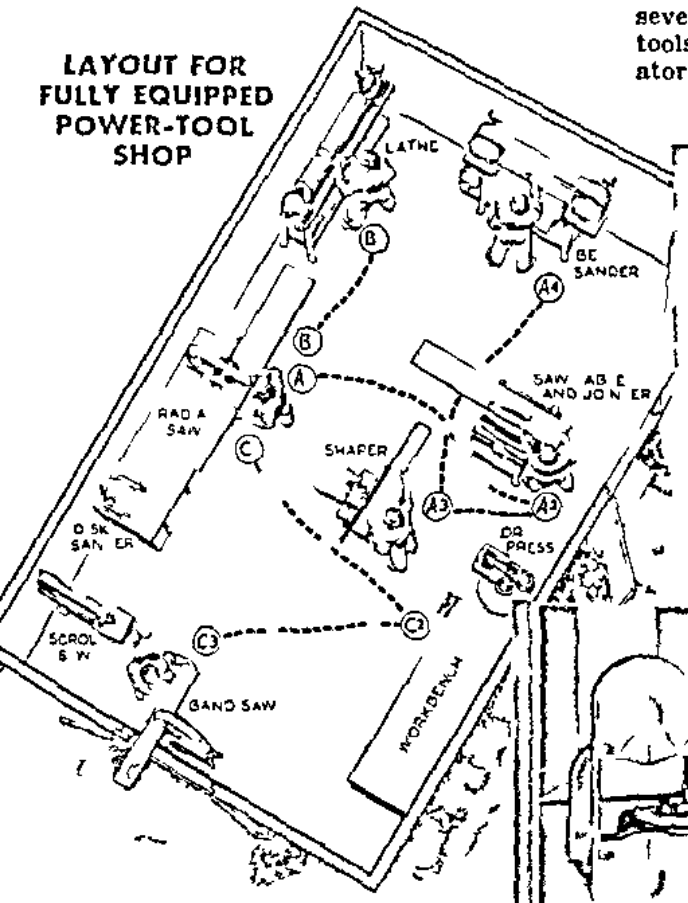
What about the arrangement of a commercial shop or one for a home workshop club?

Always arrange the machines to save as many steps as possible In the mass production of an article the machines needed should be close together Step saving is clearly shown in the diagram on this page

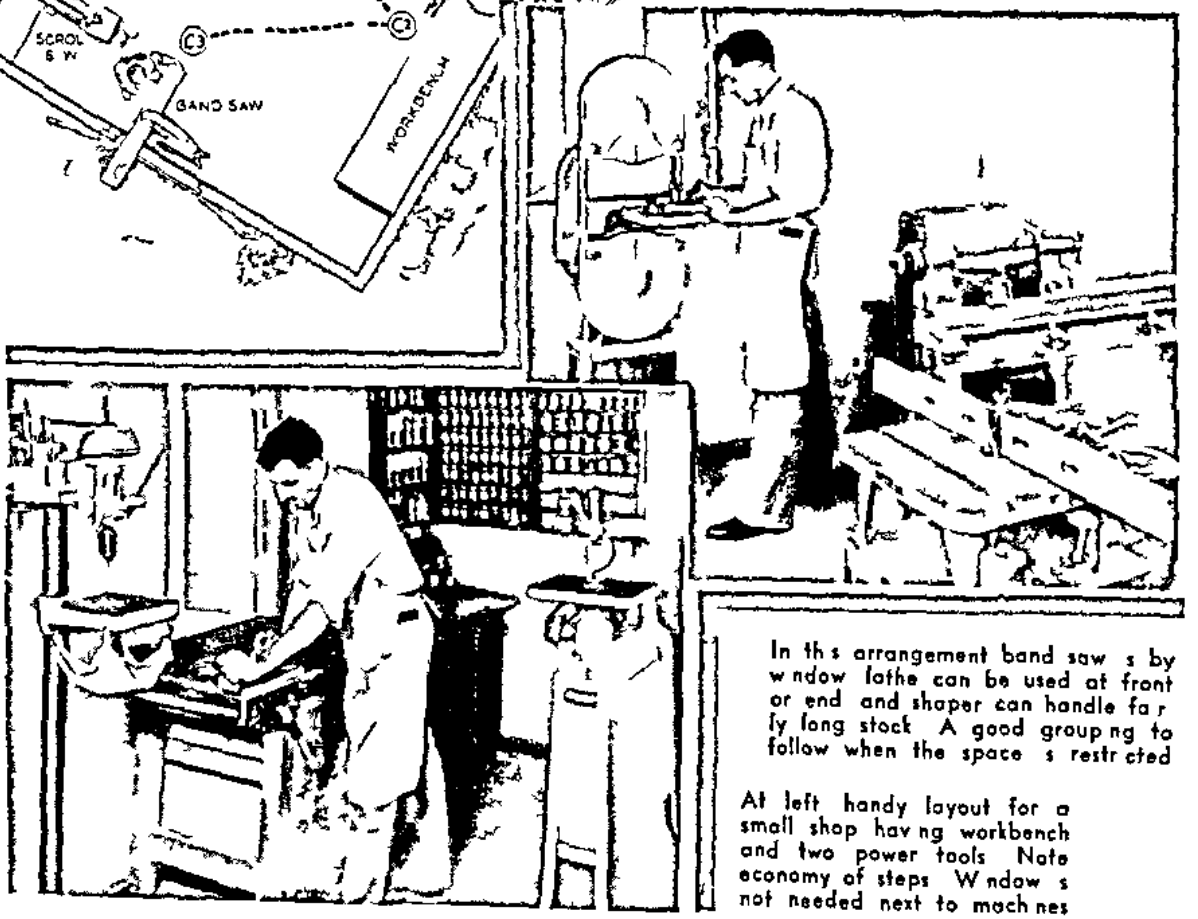
Another point to keep in mind is that if several men are working at once the power tools should be so arranged that the operators do not get in one another s way

(TO BE CONTINUED)

LAYOUT FOR FULLY EQUIPPED POWER-TOOL SHOP



When planning a well equipped shop such as for a home woodshop club arrange the layout in advance as a guide for placing electric outlets and other facilities The one at left is for a room 12 by 20 Note how this layout saves steps For example A 1 operator cuts board off A 2 rips and joints it A 3 shapes molding A-4 sands it For a turned project B 1 he cuts stock to length B 2 turns it For bandsawed work C-1 he cuts stock to length C 2 lays out pattern C 3 bandsaws it



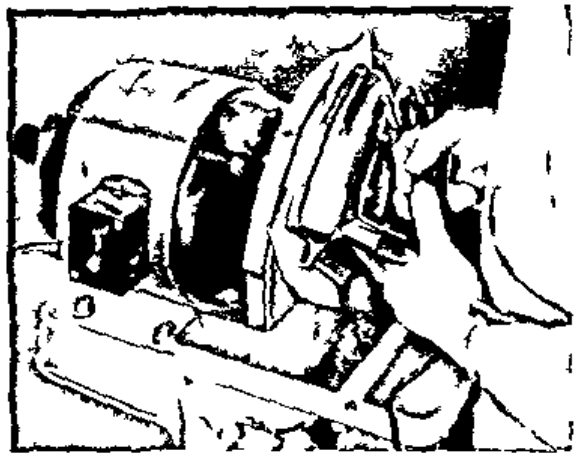
In this arrangement bandsaw is by window lathe can be used at front or end and shaper can handle fairly long stock A good grouping to follow when the space is restricted

At left handy layout for a small shop having workbench and two power tools Note economy of steps Windows not needed next to machines



Electric Iron Smooths Sanding Disks

STICK adhesive applied to sanding disks is likely to produce an uneven coat especially if the metal is cold After putting the sand paper disk in place cover it with a sheet of wrapping paper and press it with a fairly warm electric flatiron The disk will adhere quickly and all lumps of adhesive will be leveled off —LESLIE KINNING



The disk of sandpaper is covered with wrapping paper and pressed with a fairly warm electric iron

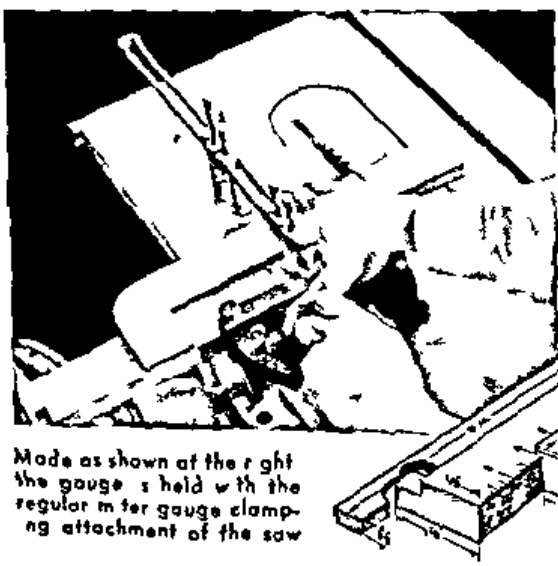
Two-Ply Baseboard Bends to Fit Curved Wall

BENDING baseboards to fit curved walls can be done readily if two or more thin layers are used as illustrated above Apply them to the wall separately Fasten the inner layer or layers with screws and the outer one with finishing nails If the bend is sharp enough to require it screws can also be used at the bottom of the outer layer where they will be concealed by the floor molding —JOHN MODROCH

Using Blowtorch Near Woodwork

WHEN it is necessary to use a blowtorch on plumbing near beams flooring or other woodwork a quantity of wet powdered asbestos may be placed on the area where the flame might reach to prevent a fire hazard

Adjustable Cut-Off Gauge Added to Circular Saw

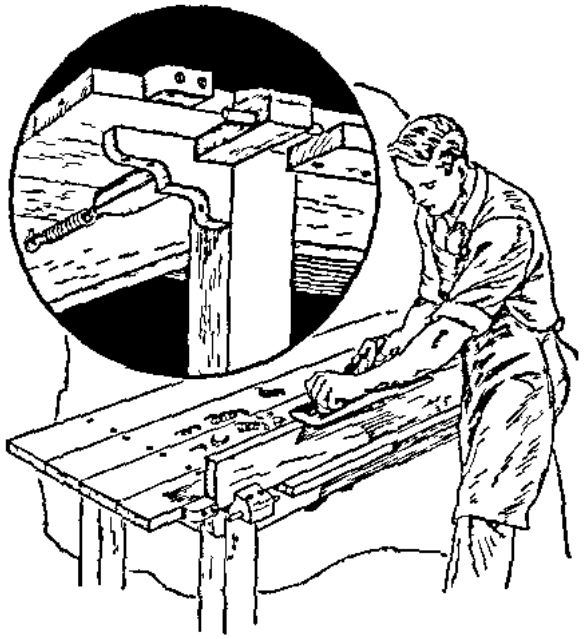


Made as shown at the right the gauge is held with the regular miter gauge clamping attachment of the saw

IF THE miter gauge of your circular saw is equipped with a clamping attachment, you will find it easy to cut small pieces of wood to exact size with the aid of this adjustable stop In the original the measurements on top of the body piece were scribed in and afterward inked but a short rule may be let into the wood and will serve as well Dimensions of the original attachment are given at the left.

In use the jig is slipped under two of the clamping screws and the right edge of the body section is brought just up to the saw teeth and clamped The sliding stop block is then set at any point desired and clamped G H S

Planing Vise Adjusts Itself to Any Wood

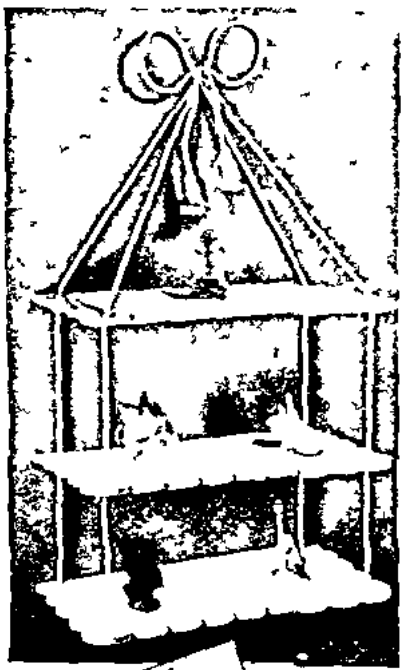


FOR planing the edges of different thicknesses of wood, ranging from very thin up to 2", I have for years used the quick acting vise shown at the right It can be made small for model work or larger for general work One great advantage is that it does not obstruct the surface of the workbench as is the case with the V-type planing stop so often used A powerful spring is required The one on my vise was taken from an old iron bed —ABBOTT B DAVIS

• • •

IN LAYING out accurate measurements on wood it is best to make the marks with a knife or a rather hard sharply pointed pencil If the rule is old and worn measure from the 1" mark rather than the very end

Light Hanging Wall Rack for Small Ornaments

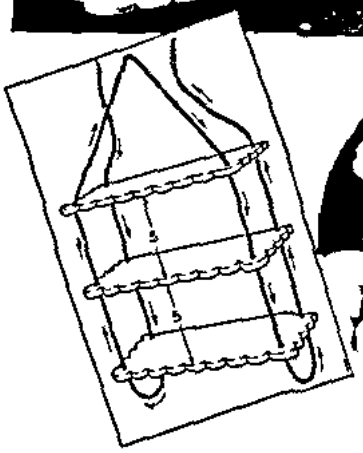


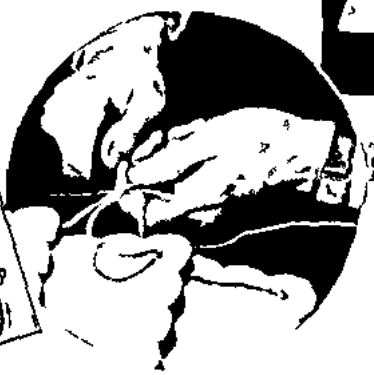
INDOOR clothesline is used as the support for the three shelves of this attractive wall rack for holding small ornaments The shelves themselves are laid out on ¼" plywood and the scalloped edges are cut with a scroll saw In the corners 3/16 holes are drilled for the cord. One coat of flat white paint or enamel undercoater is applied and one or two coats of enamel of any color.

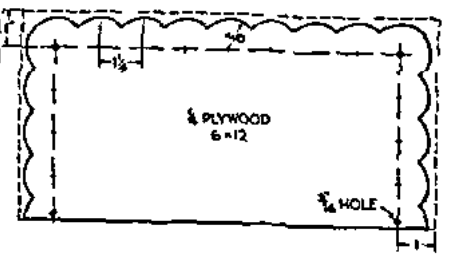
In stringing the shelves, one piece of cord is used It is carried through the holes as indicated by the arrows in the assembly diagram To support the shelves, string is knotted around the cord as shown in one of the photographs Tassels are formed on the loose ends of the cord by unraveling the strands Adjust the shelves to hang evenly before tying the bow permanently

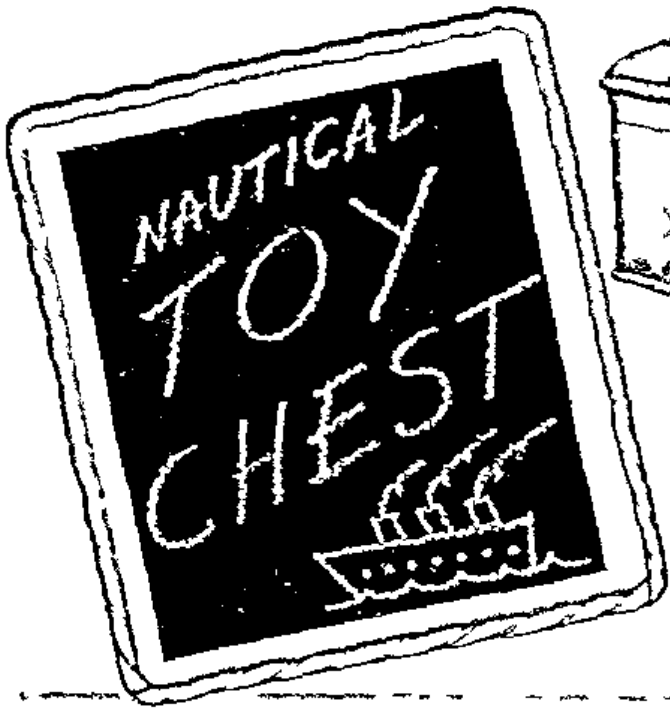
Scalloped edges are sawed on the shelves which are then painted and strung together by means of one length of white cotton indoor clothesline

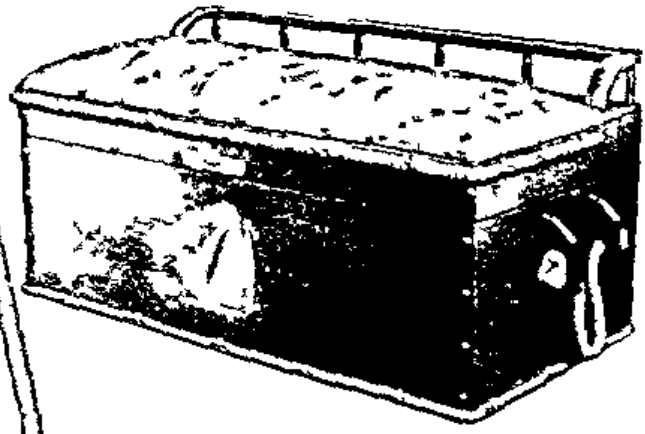








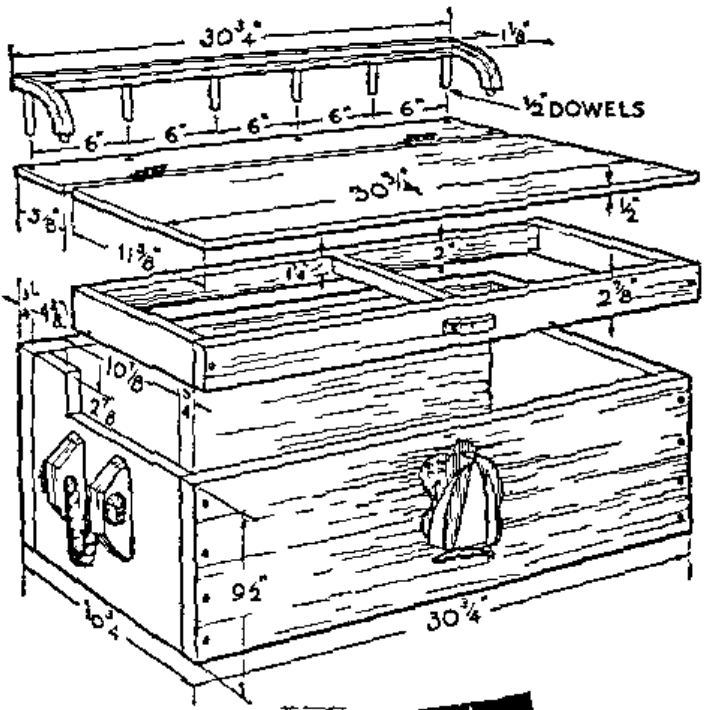


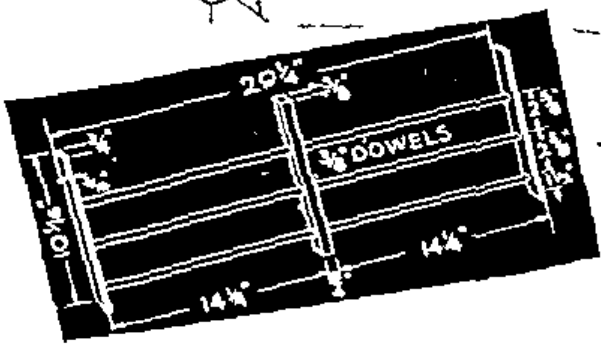


By CHARLES JEGLINSKI

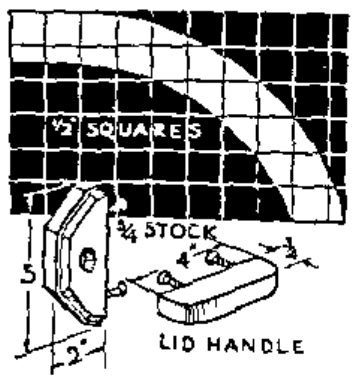
A SEAMAN'S ship chest suggested the design of this useful piece of furniture. It can be used for holding toys, and there is a rack in the cover for story and painting books. The lid which is upholstered, serves as a handy seat for dressing a child. The chest is equally appropriate for older boys and girls.

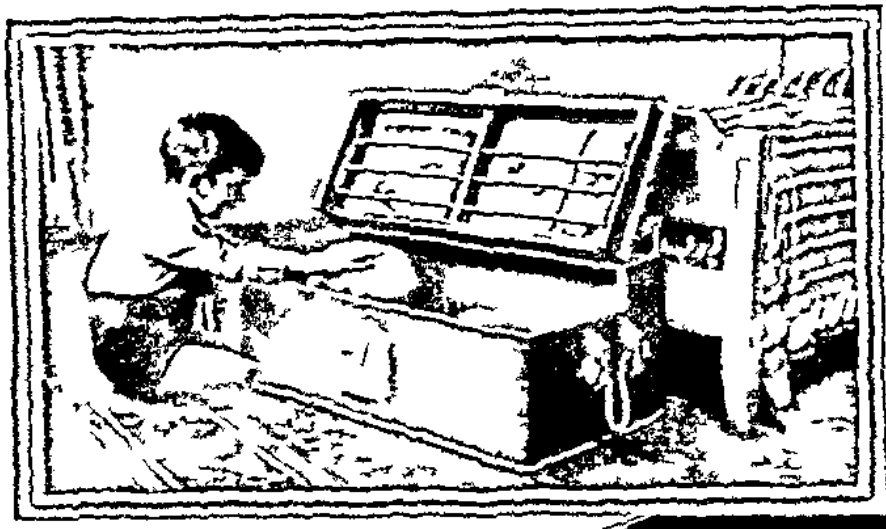
Pine, cypress or other softwood may be used. The chest proper is first assembled from ¾" boards. It can be built as an entirely inclosed box, and the lid section then cut away, or it can be made up of boards of assorted widths. However, I happened to have a 9½" board, so in making the original I fastened two pieces 9½" by 30¾" and two pieces 9½" by 15¼" with screws set into counterbored holes. These holes were plugged with ⅜" dowel pegs ⅜" long, sanded round on one end. The bottom was cut and nailed inside, the nails later being covered by the rope trim. A three sided top section was



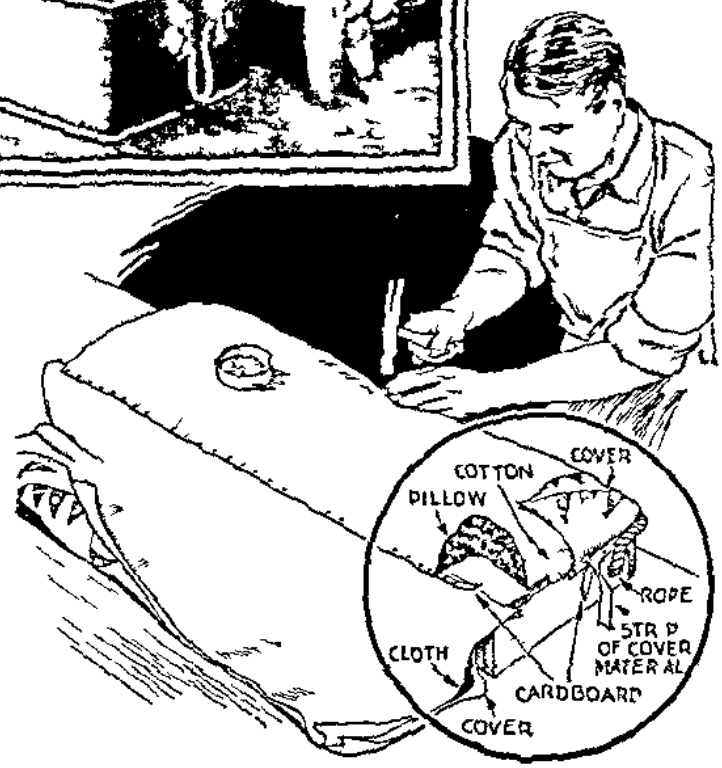








The chest holds a lot of toys and there s a rack n the cover for story and pa nt ing books The l d is upholster ed n the s mple way shown below



then made to fit on the upper edge of this box at the rear It was doweled and glued in place and a ¼" board 5⅛ by 30¾ was glued over this

In making the cover frame notice that the front piece overlaps the two sides and the back fits on the inside The front is screwed and dowel pegged to match the chest A top ¼" by 11⅝" by 30¾" is glued and nailed on The bookrack is then added as shown.

The ornamental rail is shaped on the spindle shaper but it could simply be beveled The back and sides are mitered together Cut the sides to the quarter round shape indicated and assemble with dowels

Four handle brackets are cut from ¾" stock and given a molded or beveled edge Bore a ⅝" hole in the center of each for the rope handles Screw the brackets from inside of chest and use glue also They are placed 5¼" from the edges of the chest front and back and ½" from the top Do not add the rope handles until after staining and finishing the chest

Maple stain is brushed on the wood and wiped off with a clean cloth Allow this to dry overnight then apply three coats of thin orange shellac Rub with 3 0 steel wool Add a hand painted boat or a nautical decalcomania (transfer) if desired Then polish the wood with furniture wax

For upholstering a nautical design in chintz or cretonne is used The cloth with the finished side down is laid to overlap the back edge of the lid only 1" A piece of any ordinary cloth is laid on top of the upholstery material. Cut a ¼" wide strip of thin cardboard and tack to the very edge of the lid over the edge of the two fabrics.

A pillow is now sewed up to the width and length of the cover Fill it with mohair and sew the opening Let the two pieces of cloth dangle over the back of the lid and tack the pillow in place A strip of cotton is next laid around the two sides and front to pad the sharp edge of the cover The two fabrics are pulled over the pillow and tacked to overlap the sides and front 1"

Cut a strip of the upholstery material 1½" wide and long enough to go around the three sides of the lid Cut a strip of cardboard ¼" wide and fold the cloth around to make a binding Tack this around to cover the tacked edges of the cloth A ⅝" white cotton marine rope is now nailed over the binding with 1" brass roundhead nails. Large scalloped upholstery tacks are nailed in at each end to cover the ragged end of the rope Do the same at the bottom

Gun Cabinet

The cabinet is 63" high 16½" wide and 10" deep It is finished in rich amber



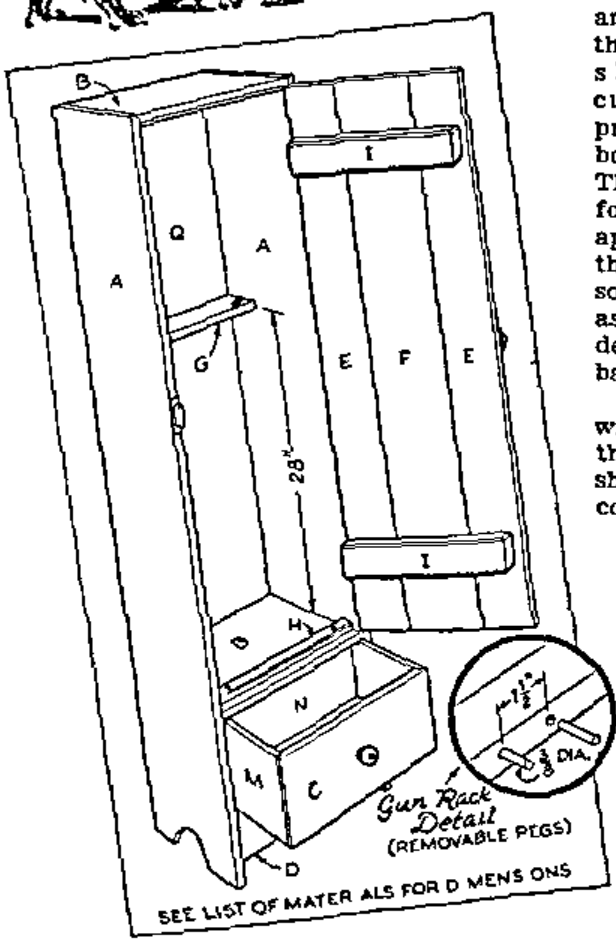
A CERTAIN rough and ready simplicity makes this knotty pine cabinet particularly appropriate for a sportsman's room It is finished in a rich amber tone and the silhouette of a dog ornaments the upper part of the door

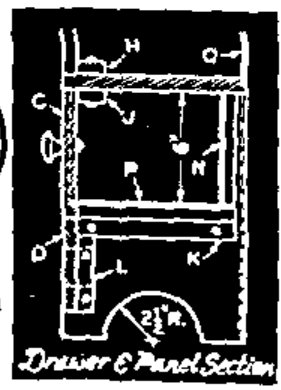
The cabinet is 63 high 16½" wide and 10" deep outside measurements Dimensions of all the pieces are given in the list of materials and the parts have been lettered for ready identification

Except for the plywood back the cabinet proper is constructed of dressed white pine The exposed parts are of a grade having sound knots the gun rack and minor parts are clear stock The thickness is nominally 1" but actually the wood is about ⅞" thick The widths can be changed slightly if necessary to suit the stock widths of the material available

The rear edges of the sides *A* and the top and bottom *B* are rabbeted so that the ¼" thick plywood back can be set in The dog silhouette (either design may be used) is cut from ⅛" thick pressed composition board and glued on The gun rack *G* is bored for pegs spaced 1⅛" apart It is best to leave these unglued so that some may be removed as necessary when it is desired to store double barreled guns

The wood is finished with amber stain and thin coats of orange shellac rubbed between coats with steel wool







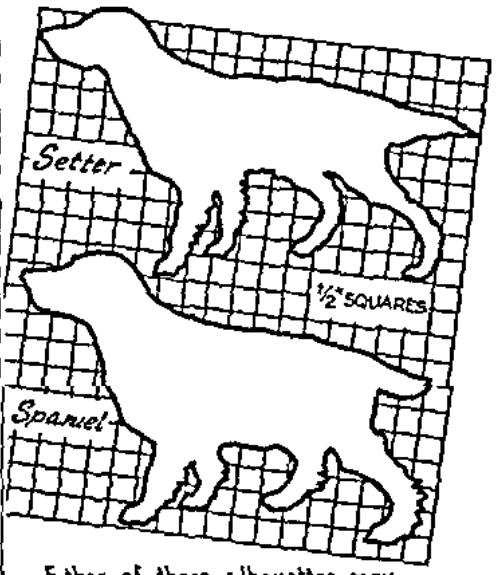
of Knotty Pine

By TOM E. MOORE
Oswego State Normal School
Oswego N Y

LIST OF MATERIALS

Part	No Pc	Name	Material	T	W	L
A	2	Sides	Knotty pine	1	10	63
B	2	Top bottom		1	10	14¾
C	1	Drawer front		1	7	14¾
D	1	Lower panel		1	5	14¾
E	2	Door sides		1	4½	48
F	1	Door center		1	5¼	48
G	1	Gun rack	Clear pine	1	3	14¾
H	2	Door stops		1	1½	14¼
I	2	Door cleats	"	1	4	14½
J	1	Drawer stop		1	1½	13
K	2	Drawer slides		1	1	8¼
L	2	Panel cleats		1	1	4
M	2	Drawer sides		⅜	7	8¼
N	1	Drawer back		⅜	6	14¼
P	1	Drawer bottom	Fir plywood	¼	8½	14⅜
Q	1	Cabinet back		¼	16	49½
R	1	Dog silhouette	Pressed wood	⅛	9½	5½

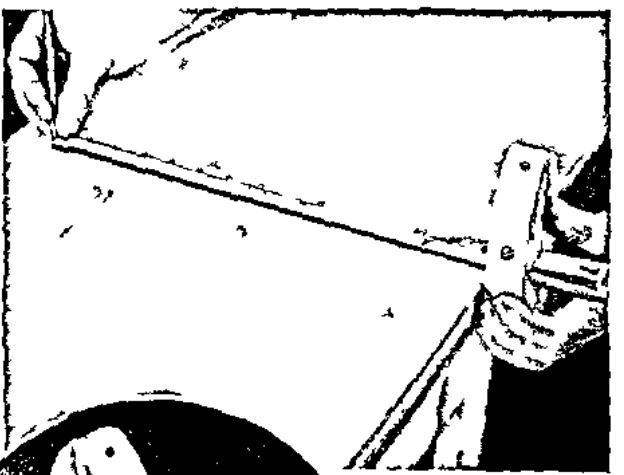
Note All dimensions are given in inches



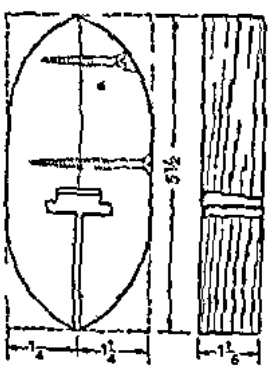
Either of these silhouettes may be used to decorate the cabinet

Gauge Simplifies Panel Marking and Saw Jointing

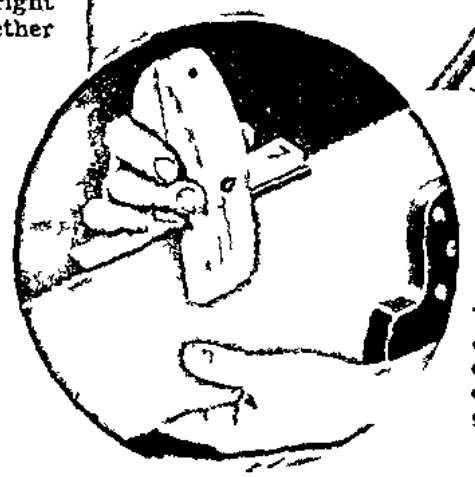
MADE on the circular saw in a few minutes this hardwood gauge is used on a yardstick for marking panels and other large work It also serves to hold a piece broken from a discarded file of about the same cross section as the yardstick so that the teeth of handsaws can be jointed easily to a straight line Shape the parts as shown in the drawing below but don t cut the bevel for the wedge slot until after the wedge is made The slots can be cut on a circular saw Be sure to make the two main parts of the gauge a pair that is right and left hand so that they fit together correctly —R L.



Using the hardwood gauge and an ordinary yardstick to mark a measurement on plywood

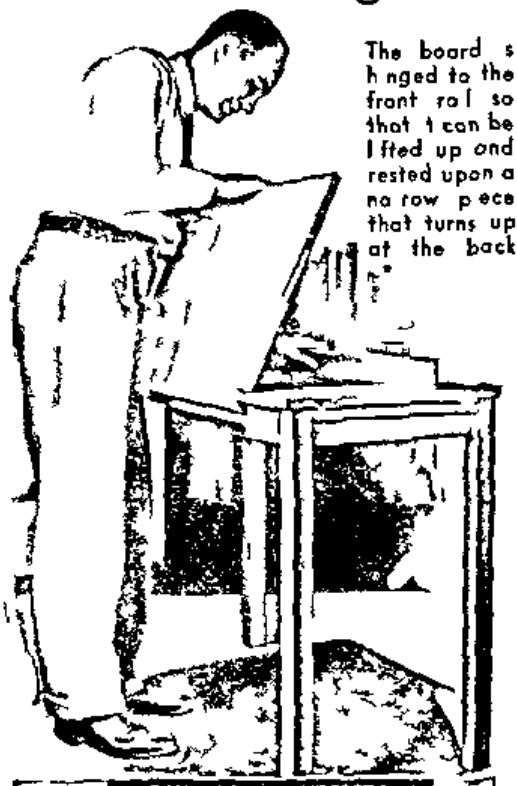




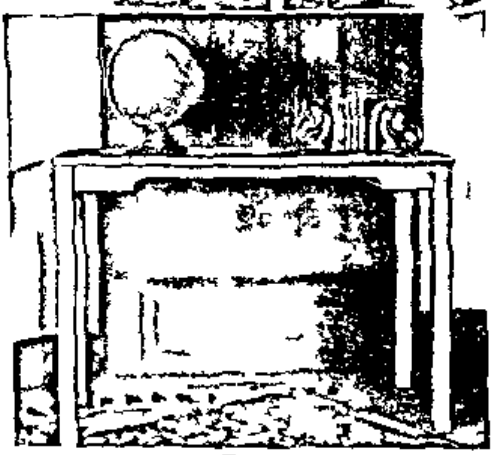


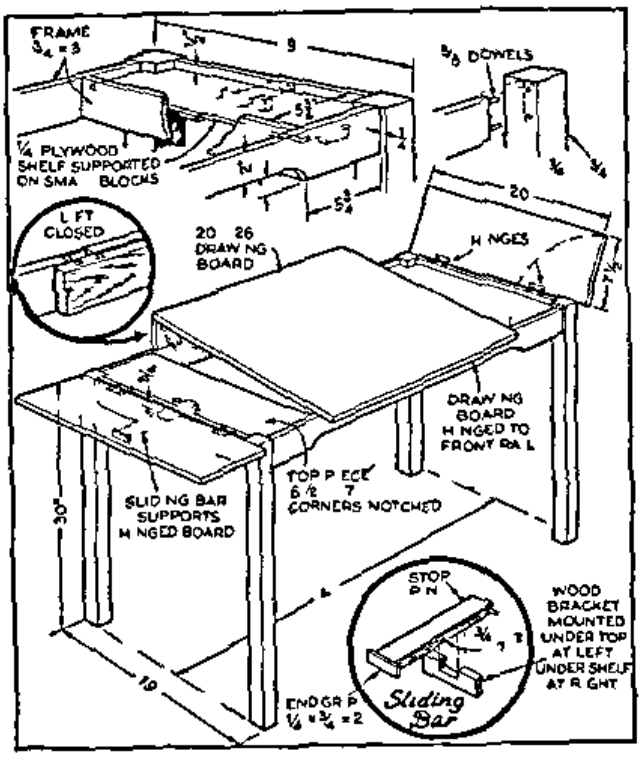
To joint the teeth of a handsaw file a piece of a discarded file in the gauge as at left

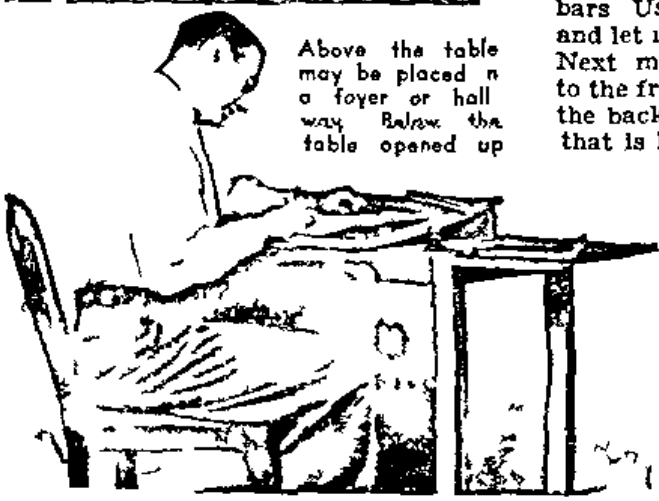
A Drafting Table for Use at Home



The board s h nged to the front ra l so that t can be l fted up ond rested upon a na row p ece that turns up at the back







Above the table may be placed n a foyer or hall way Below the table opened up

HERE is a home drafting table suitable for a small apartment When closed up it can be placed in the foyer or hallway and looks like an ordinary flat topped table

The center section of the top is a standard drawing board purchased in an art supply store The remainder is constructed from clear white pine The only hardware required is four pair of brass butt hinges $2\frac{1}{2}$" long and about $1\frac{1}{2}$" wide when open

Use a jig for lining up the holes in the rails and legs for the $\frac{3}{8}$" dowels with which the table is assembled Before gluing cut the front rail to the shape shown and cut $\frac{3}{4}$" by $1\frac{1}{2}$" notches in the side rails for the slid ng bars Use long bar clamps in gluing the frame and let it dry overnight before removing them Next mount the drawing board by hinging it to the front rail so that it can be lifted up from the back and rested on another piece of wood that is hinged to the back rail

Sand the table thoroughly and either apply a sta ned finish or paint to match other furniture or wood work in the room —A J SODARO

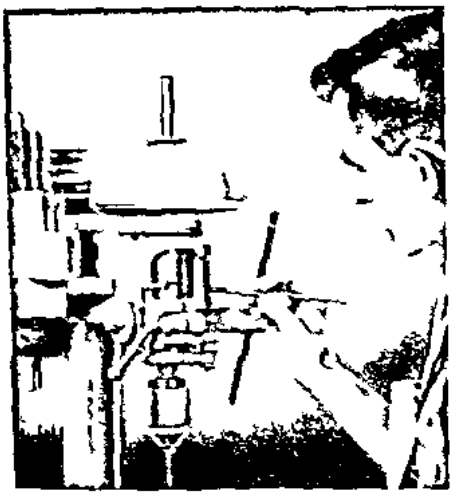
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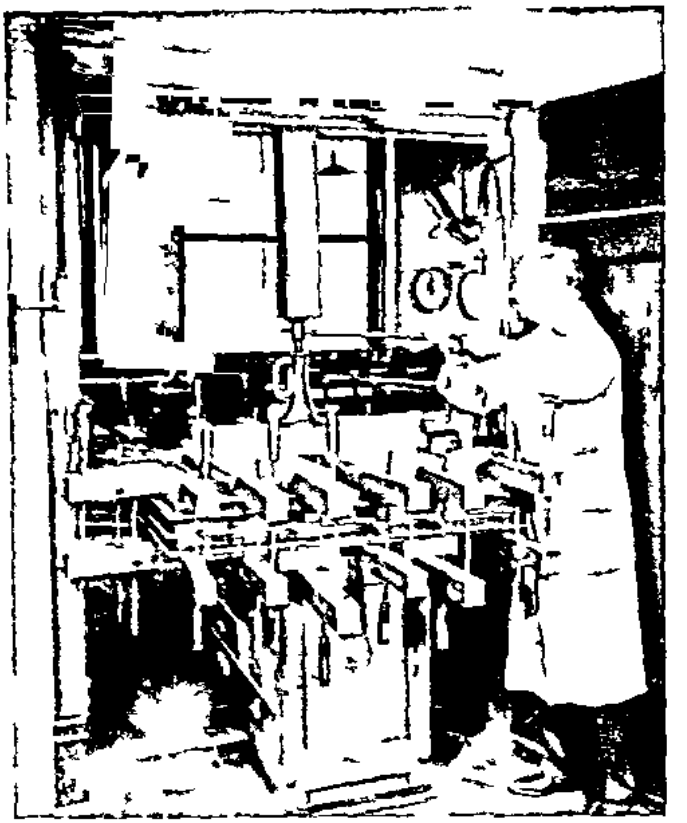
A 1-QT CARDBOARD milk carton that has been washed out makes a good quart measure for use about the shop or home with oil and other liquids The measure may be thrown away after use —O W LYON

Stripes of Paint Anchor Stop Nuts on a Drill Press

DRILL PRESS stop nuts often loosen and work down the screw when the machine is being used for boring holes of uniform depth This can be prevented by applying a stripe of varnish or paint length wise of the screw When dry it makes the nuts bind sufficiently to hold one in position long enough to drill two or three holes

This procedure avoids the bother of running the lock nut down the screw and often saves considerable time —L. K.

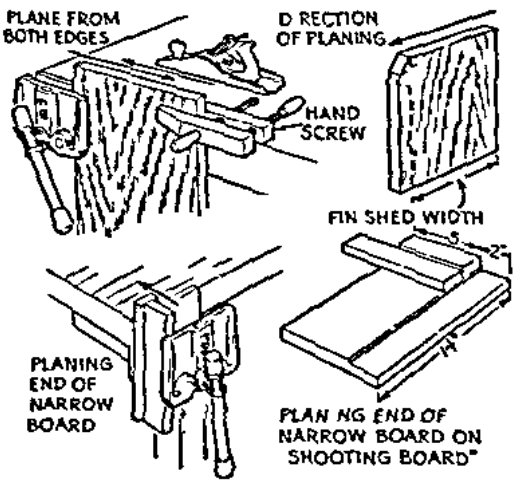




Jack Acts as Veneer Press

CONFRONTED recently with the problem of recovering a number of badly worn table tops with linoleum I rigged up a large veneer press under a good sized brick lintel A house jack and a piece of 4" by 4" stock provided pressure at the center and hand screws were used around the edge.—E. C H

PLANING END GRAIN [WOODWORKING]



1 If the board is wide enough to be planed halfway from both edges support the free end on the bench top by clamping a hand screw to it as shown 2 If the board is narrow but nevertheless wider than the finished width is to be cut off one corner to prevent wood from splitting 3 When the board is narrow and of the finished width clamp another board behind it in the bench vise A shooting board like the one illustrated may also be used in this case Hold the board against the stop and use the plane resting on its side A jack plane smooth plane or block plane can be used on end grain depending upon circumstances but for most small work the block plane is best.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

NEW SHOP IDEAS



Draw-In Chuck

By
C. W. WOODSON

SPRING collets afford an accurate convenient and speedy means of holding drill rod and other finished bar stock in the lathe as illustrated in Fig 1 They can easily be adapted to a precision lathe by the home made draw in chuck at tachment shown in the accompanying photographs and detailed in the drawings at the end of this article The drawings are exactly half the size of the attachment made by the writer for his own small lathe but the dimensions obviously will have to be adapted to the lathe with which the draw in chuck is to be used

A collet adapter draw in spindle and spindle cap Fig 2 are the parts needed and these can be made on the lathe itself This particular attachment was designed for a 9" lathe with a ¾" hole through the headstock spindle The collets themselves may be purchased or made

The handwheel in this instance was taken from a discarded valve It was however given a finished appearance by being machined all over and polished bright It was then bored to fit the hollow draw in bar as in Fig 3

The hollow bar is a piece of cold drawn seamless steel tubing 13½" long with an outside diameter of ¾" and an inside diameter of 9/16" This was chucked in the lathe to run dead true and bored and threaded ⅝ —26 threads on the inside to receive the end of the collet The tube was

now placed between centers and turned smooth as illustrated in Fig 4 The center section was relieved slightly in this operation to avoid any possibility of its binding in the headstock spindle hole

For the next step it was necessary to fit the handwheel to the tube To clear the gear guard of the lathe the wheel had to be placed in back of a long collar The collar was recessed to fit over the back end of the spindle as shown in the drawings This recess accurately centers the outboard end of the drawbar when in use

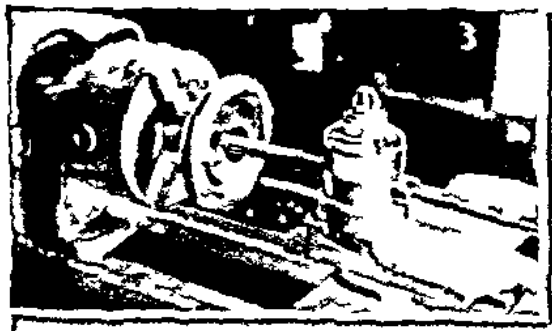
The collet adapter shown in Fig 2 is best made from a short bar of tool steel Turned to dimensions and finished on the outside as in Fig 6 it was cut off and inserted in the spindle hole of the lathe Here it was drilled and bored as in Fig 7 and then carefully brought to dimensions that is twice the size shown in the drawings Great care was taken in the boring of this part, as the collet must be supported at each end only and have clearance in the center for spring The accuracy of the whole attachment depends largely on the accuracy of the work on the collet adapter Every effort should be made to machine it perfectly

A feather as shown in the drawing is needed to drive the collet and the adapter was drilled as in Fig 5 to receive it. Riveting this in place finishes the adapter which is then ready to receive the collets These may be purchased or made up by the method to be described

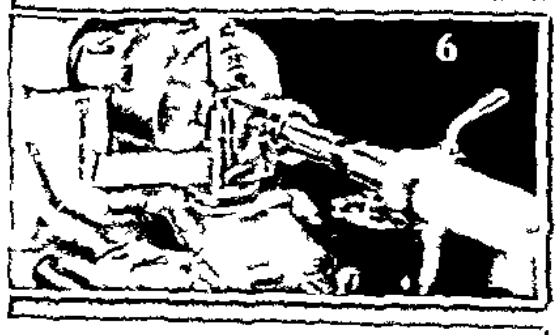
The spindle cap also shown in Fig 2 was made to afford protection to the threaded end of the headstock spindle nose A short piece of cold rolled steel was chucked as in Fig 8 bored and threaded the inside dimensions exactly duplicating those of the small faceplate that comes with the lathe When threaded and counterbored it was knurled while chucked as in Fig 9 This finished the work on the attachment.

The spring tempered collets are best made from tool steel hardened tempered and ground accurately to size A set of eight ranging in size from 1/16 to 1 " by six

and Spring Collets



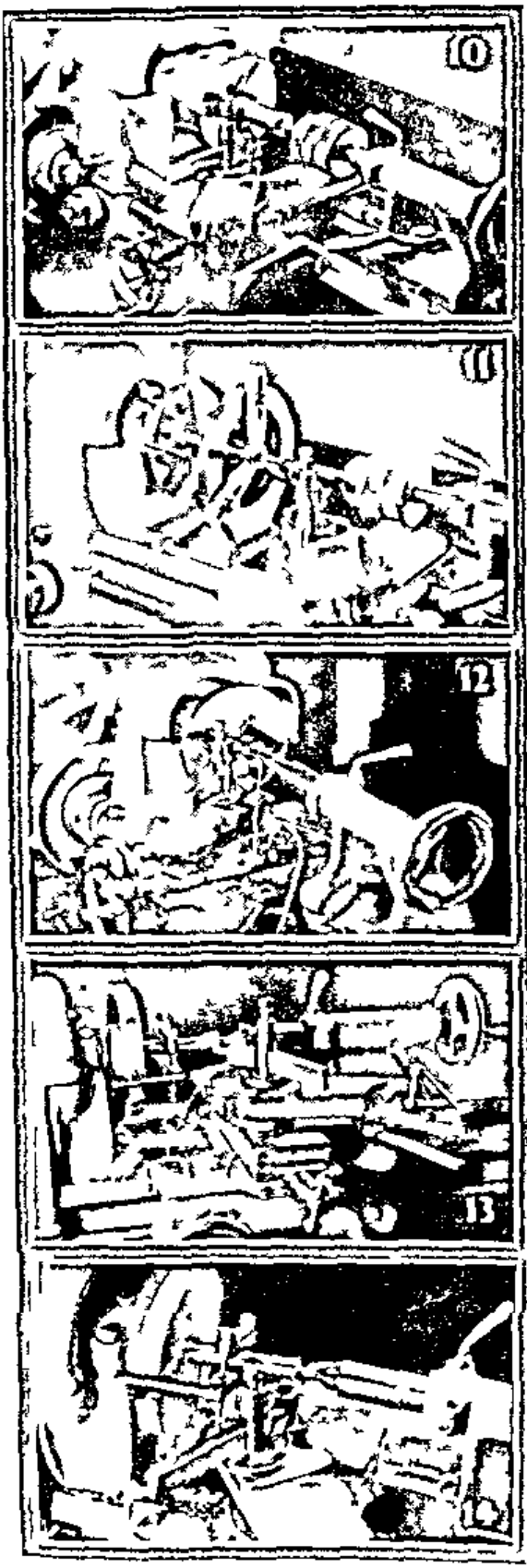












teenths is desirable (Fig 2) It is well to use a bar of steel slightly larger in diameter than the collet and ¼" longer This makes the blank about ⅞" by 3" which is chucked as in Fig 10 and centered on both ends

A roughing cut is taken before mounting the stock in the center rest where the large clearance hole is drilled and bored (Fig 11) The outer end of the hole is beveled 60 deg to receive the tailstock center and the collet is turned to shape as shown in Figs 12 to 15 A slight allowance must be made for grinding to exact size after hardening

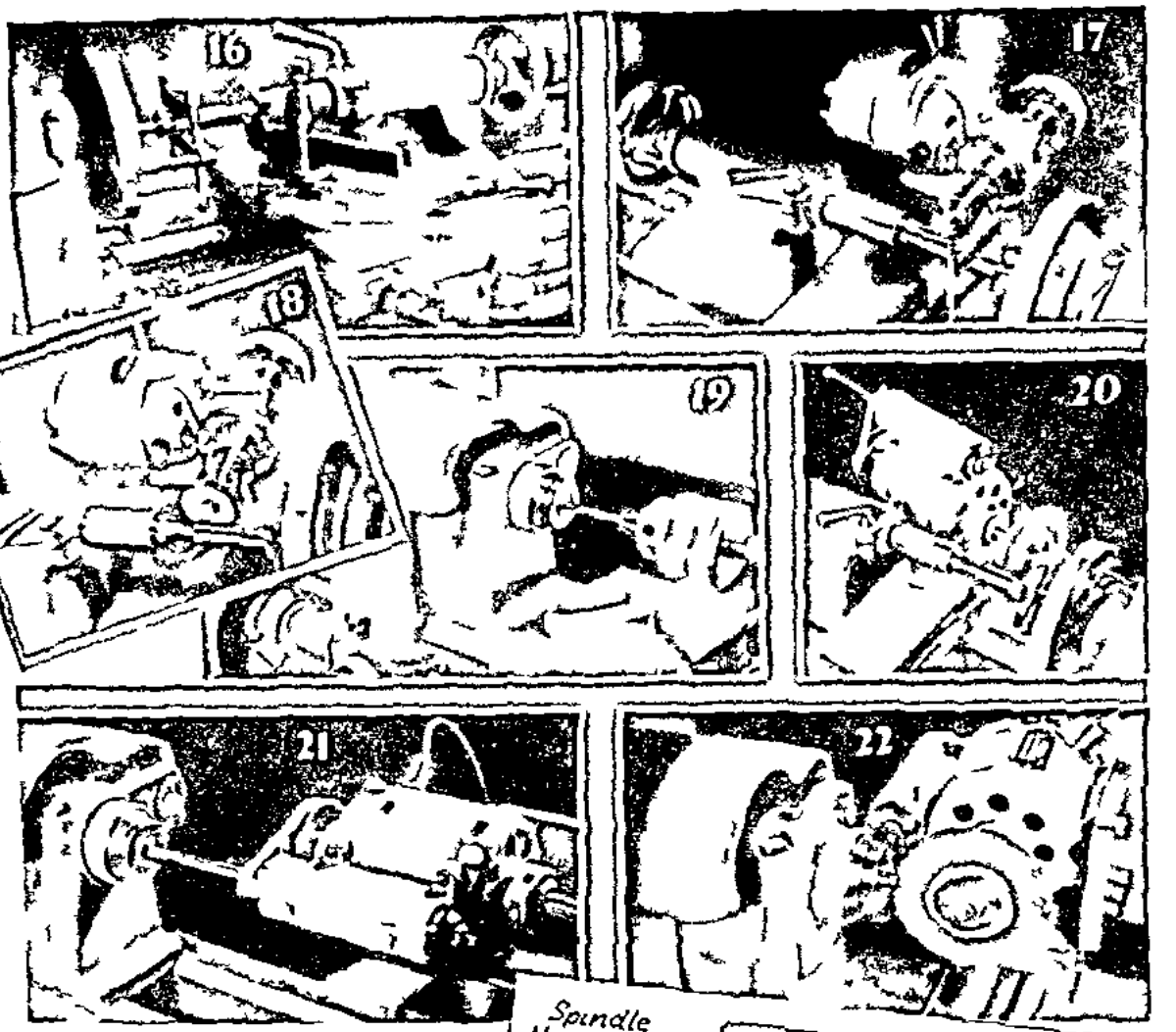
The ⅝"—26 thread is cut on the end as shown in Fig 16 to fit the threaded hole in the draw in spindle While still in this position the keyway for the driving feather is milled as in Fig 17 and the three slots are cut (Fig 18) These slots are not cut through the center support left on the collet but should be cut far enough out to clear the hole and far enough back to allow for spring in the collet The metal slitting saw should be thin and of small diameter

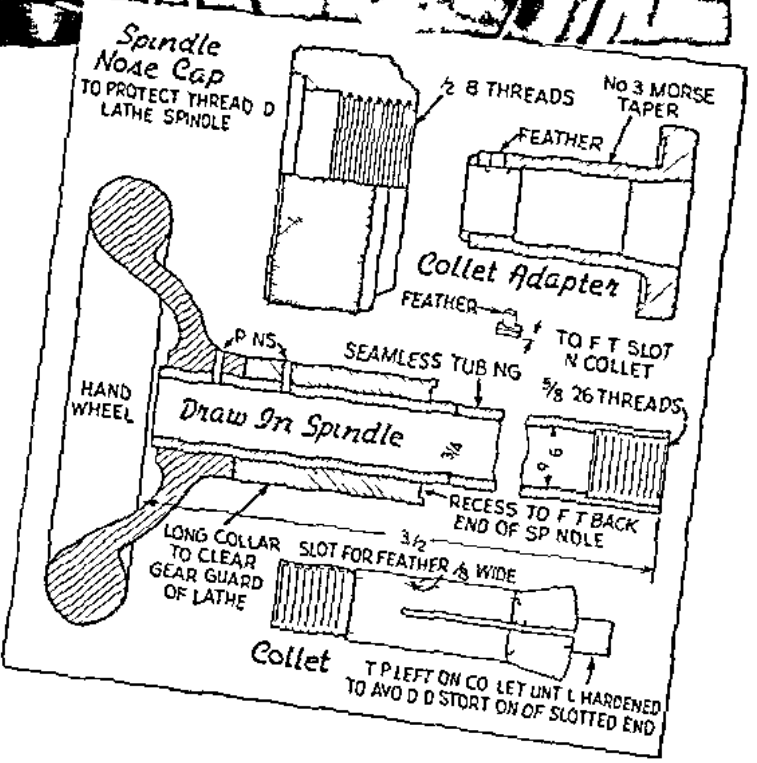
The collet can now be mounted in the adapter in place on the lathe spindle as shown in Fig 19 where the hole to receive the work is drilled slightly smaller than finished size to allow for grinding after hardening The finished hole size should now be stamped on the end of the collet and it is ready for hardening and tempering

If an open fire is used for hardening it is best to place the collet in a metal tube and bring to a low red heat Then plunge it a



Checking diameter of collet blank after it has been turned





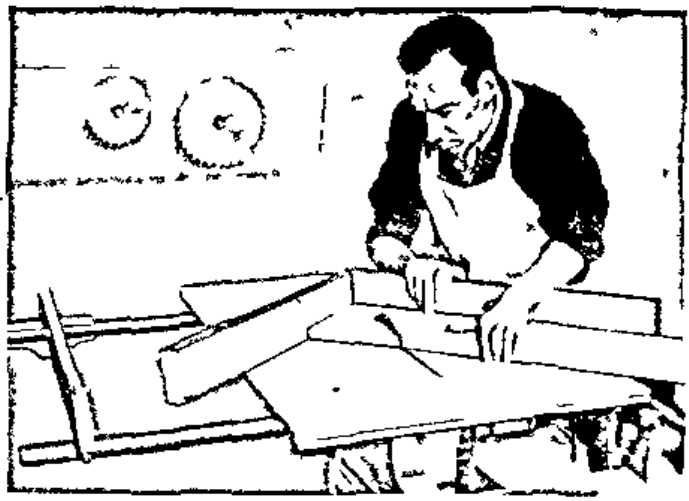
l ttle over half its length in wa ter The temper is now drawn and the collet is ready for grind ing to finished size This is done in the lathe with a tool post grinder as shown in Fig 20 or a hand motor grinder could be arranged to do the work

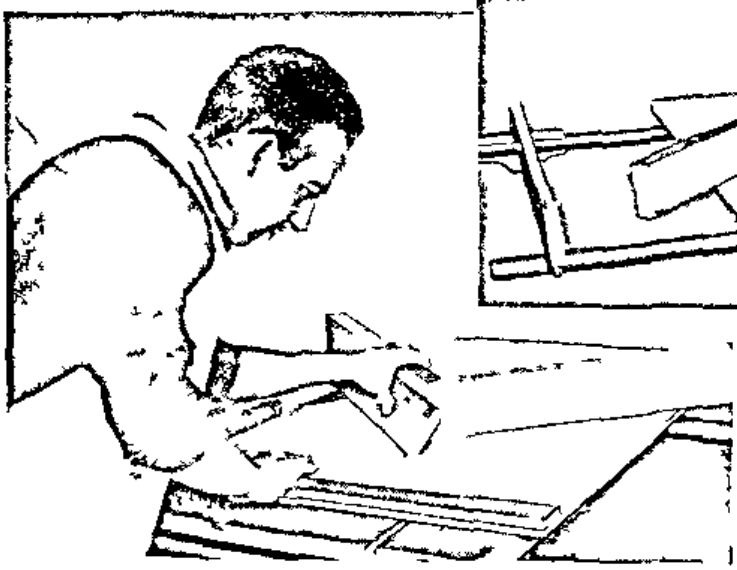
In Fig 21 the hole is being ground to size by the internal attachment of the grinder which should be operated at the highest possible spindle speed The lathe itself is run at a slow speed

Figure 22 shows the center support being ground away After being pol shed the collet is ready for use

The hole size of the collet should closely approximate that of the work to be held and the collet should never be closed without work in the hole

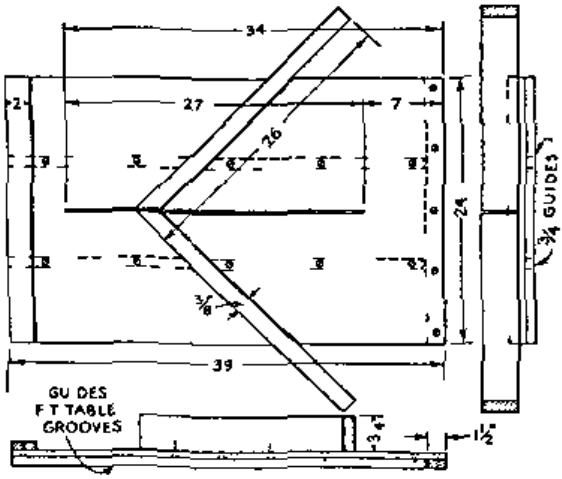
A Jig for Cutting Miters Speedily on a Table Saw





Maple strips underneath the miter board slide in the grooves of the saw table and guide the jig as a miter is cut by the circular saw

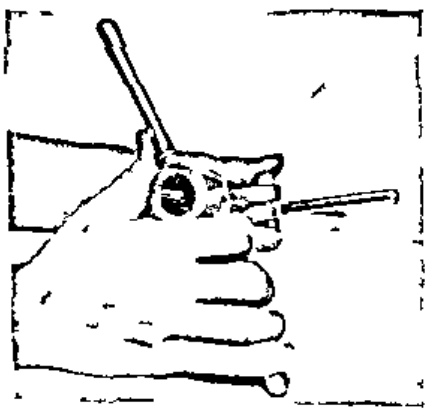
Using the jig to cut a miter on a crown molding A great many uses for the board can be found in a carpenter shop



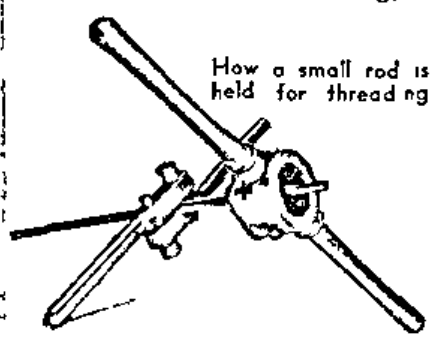
IN A carpenter shop where a great many inside and outside miters have to be cut the time spent in making this miter board for a circular saw will be saved over and over again

The board is made of ⅜" plywood with *maple cleats* at the ends one on top and one below as shown Maple guides are fastened with screws through the top to fit the saw table grooves accurately These should be so placed that the saw cut may be made in the middle of the plywood after the guides are in place by turning the saw up through the plywood Fasten the fences accurately and strongly with screws from the underside after placing glue beneath the mitered ends —CHARLES A KING

Tap Wrench Holds Rods and Tubing for Threading



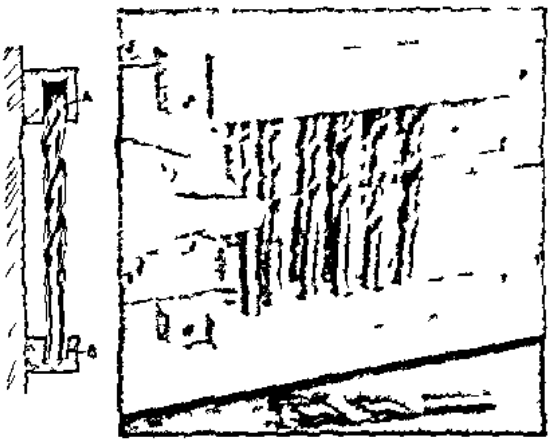
A TWO PIECE adjustable tap wrench of the ten cent *variety is useful as an improvised vise for holding* small diameter rods tubing, or pipe for threading It gets a good grip without excessive pressure, and doesn t chew the stock up I have even threaded ⅛ iron pipe in this way without difficulty *The wrench* can be carried in the pocket and eliminates the need of a heavy vise —A T



How a small rod is held for thread ng

Wooden Rack Protects Bits from Damage

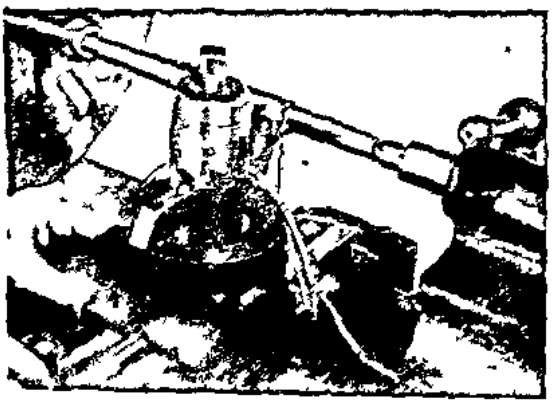
For holding twist drills, auger bits, and other tools which should have their ends protected, a rack may be made of two strips of wood with holes bored as shown below The strips are so spaced that when the upper end of the tool is pushed into an upper hole, the lower end can be swung in and dropped into a lower hole, yet the tool does not drop down so far that the upper end is released. To remove the tool, simply lift it up and swing the lower end out.



Rack made of parallel wooden strips having holes aligned vertically Upper holes must be deeper

Two Small Tapered Parts Turned at One Setting

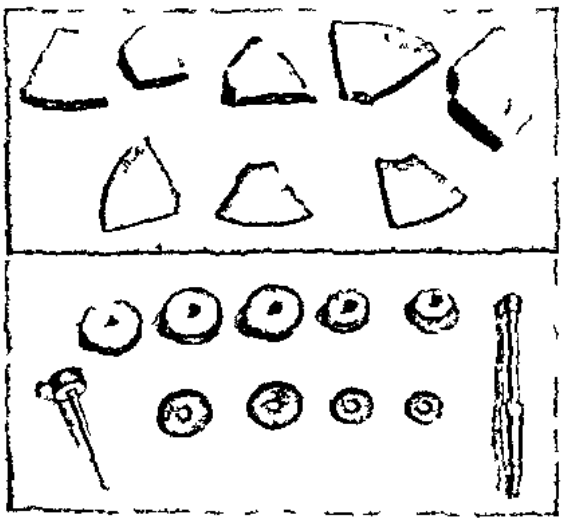
Considerable time may be saved when turning several tapered parts for lathe fittings handles and the like if two are turned on one piece of stock. Separate the tapers after fitting to the socket In the case of lathe fittings, insert the tapered shank in the headstock spindle to hold it while doing any additional machining





Workshop Towel Hangs from Rubber Holder

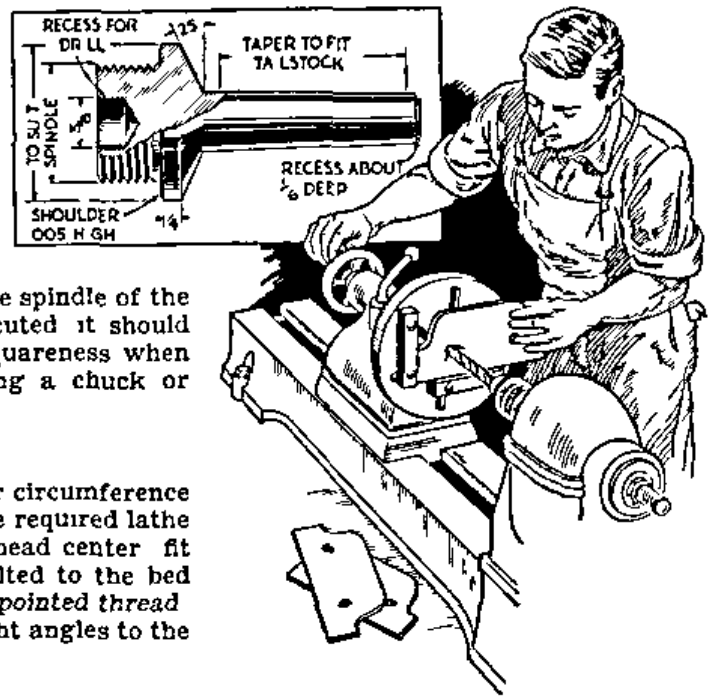
If a short piece of radiator hose, cut as shown is tacked on the wall of the workshop above the lavatory, it forms a quick-acting holder from which the towel may be jerked carelessly without being torn



Worn Grinding Wheels Cut into Tiny Ones

Tool-post grinding wheels 1" in diameter and smaller are rather expensive in comparison with wheels from 4" to 6" When, therefore bench grinder wheels of 1/8" to 1/4" face become worn too small to cut properly or are accidently broken, it pays to cut them up into small wheels Chalk one side white, draw the desired circle with pencil, and drill the hole with a regular drill, but use water for a coolant Shape the diameter with a bench-grinder wheel, then dress the small wheel as required.

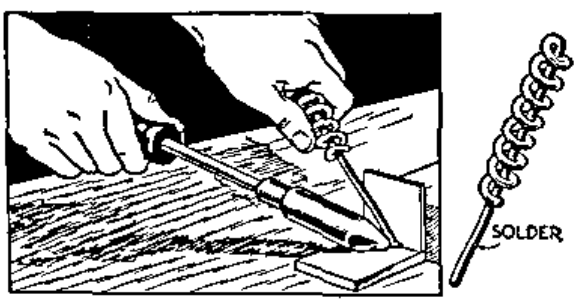
Lathe Tailstock Arbor Holds Faceplate or Chuck



AN ARBOR of the type shown is a useful lathe accessory for holding a chuck or faceplate in the tail stock It is handier than an ordinary drill pad because when a faceplate is fitted to it metal or wood pieces can be attached to serve as a jig for drilling duplicate pieces The drill or drill chuck is held in the headstock spindle The special arbor should be finished in the spindle of the lathe If the work is carefully executed it should be true to less than 0 001 as to squareness when placed in the tailstock for mounting a chuck or faceplate ELMER A HUBBARD

• • •

TO GRADUATE accurately the side or circumference of a handwheel or similar part fit the required lathe threading gear to a suitably made head center fit an indexing screw to a member bolted to the bed *of the lathe and scribe with a sharp pointed thread* ing bit set in a tool holder and at right angles to the conventional position —H J C



Solder Coiled Compactly

A CONVENIENT way to handle wire solder especially when it is necessary to get into tight places is to roll it around a pencil then pull the pencil out and push one end of the wire back through the center as illustrated at the left Wind the loose end down around the straight end As you use up the solder pull the end out —P R.

INK FOR MARKING METALS [FORMULAS]

Gum arabic	8 grams	Copper Sulphate	20 grams
Sal ammoniac	16	Hydrochloric acid concentrated	10 cc
Lampblack	4	Water	20 cc

Soften the gum arabic in the heated water add the acid slowly while stirring then the sal ammoniac next the copper sulphate and finally the lampblack Apply with a fresh steel pen a quill cut from a large feather or a rubber stamp Before using the ink see that the metal is freshly polished and clean it with denatured alcohol and a cloth

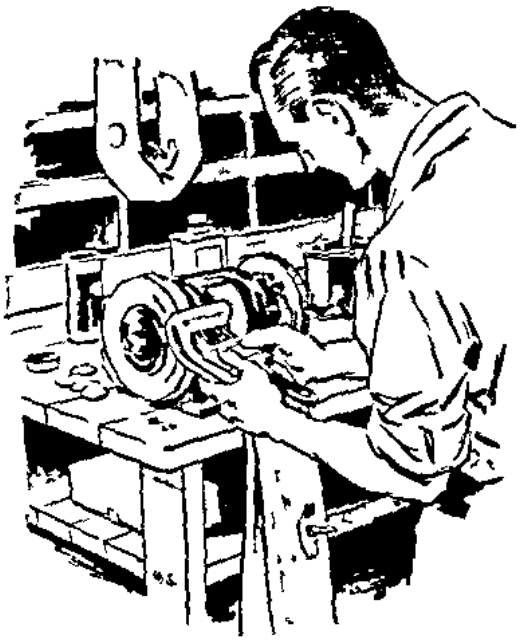
POPULAR SCIENCE MONTHLY SHOP DATA FILE

Brush Presses Inner Tube Against Buffing Wheel

IN SEARCH of a convenient handle for holding inner tubes safely against a buffing wheel preparatory to patching them one mechanic discovered that a discarded paintbrush was well adapted to the purpose as illustrated at the right

• • •

WHEN soldering the outside of the bottom and sides of milk cans pots pails and the like it helps to place an electric lamp beneath or inside the article Any holes can then be readily seen



The inner tube is held safely against the buffing wheel with the aid of the old brush

Old Table-Lamp Standard Utilized as Lathe Light



AN OLD table-lamp standard, with base removed was used for this lathe light It was fastened on the back of the carriage with a small bracket This type of illumination is most practical because the light moves with the carriage and therefore is always directed on the tool so the operator can see what is done —D D FULMER

Paper Glued to Thin Shims for Easier Handling

TO LAY out and cut shims from very thin brass or steel, first glue a sheet of white paper on the stock When dry the stock is much easier to handle, and the holes and shapes can be marked plainly with a sharp pencil The paper is removed after the shims have been cut by soaking them in water for a few minutes, then peeling it off —CHARLES HOMEWOOD

LUBRICANTS for Drilling, Counterboring, Countersinking [SHOP METHODS]

MATERIAL BEING WORKED	SUITABLE LUBRICANTS							
	Dry	Milk	Lard oil	Paraffin oil	Soap mixture*	Kerosene	Turpentine	Soda water†
Aluminum						X	X	X
Babbitt			X					
Brass	X			X				
Bronze	X							
Cast iron	X							
Copper		X						
Glass							X‡	
Hard steel						X	X	X
High speed steel			X					
Lead			X					
Machine steel			X		X			X
Malleable iron								X
Monel metal			X§					
Soft alloys (of aluminum etc)						X		X
Soft steel			X		X			X
Wrought iron			X		X			X

* Water 2 qt soft soap 1 oz sodium carbonate 1 oz lard oil, 1 oz Mix and *boil forty minutes before using*
† *Sodium carbonate (sal soda washing soda etc)* in water The sodium carbonate used by photographers will do
‡ Dissolving camphor in the turpentine will improve the action in drilling glass
§ Use slow speed in drilling
Note Never use lubricating oil on a drill bit

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Painting Questions



HOW TO REMOVE DRIP STAINS FROM ASBESTOS SHINGLES

My new asbestos shingle side walls have a drip stain here and there under window sills I have tried to remove these with gasoline but with no effect What should I use?

Use one cup of trisodium phosphate powder to a pail of hot water Scrub the stained area thoroughly then rinse with clean water and a sponge

WHY OUTSIDE PAINT CHECKS

Last year we painted our house blinds and now they are badly checked and alligatored Did the painter use too much drier or what is the trouble?

It is possible that too much drier was used but it is much more likely that a hard drying paint was applied over a soft coat in which case alligatoring or checking always occurs The use of prepared paints over lead and oil will cause the same thing Either system however, is good when used throughout

The only practical method is to strip the blinds in a tank of boiling trisodium phosphate solution using a pound to a gallon and scrub them clean with a palmetto fiber floor scrubbing brush Hose off with clean water let dry thoroughly sand where necessary and repaint with the new nonfading type of outdoor enamel intended for trim and trellises Two coats will be required

WHAT TO USE FOR RUBBING

I notice that you specify the use of FFF pumice stone and crude oil for rubbing varnish I have always used rottenstone and linseed oil Which is better?

FFF pumice stone and crude oil or light golden paraffin oil do a better and faster job than does rottenstone The latter is too fine and too slow for anything except polished pianos which by the way are seldom polished as in the past Linseed oil should never be used in rubbing as traces left in corners dry to a sticky mass that is hard to remove The crude oil or paraffin oil is easy to remove with a stiff brush and a mixture of one part oil and two parts gasoline Wipe clean

PAINTING WITHOUT DRIPS

I have been decorating my living rooms with the new type of water casein wall paint I find this material most satisfactory, but the brush drips badly, especially on overhead work How can I stop this?

Master painters frequently give their men two 6" brushes for this work only one of which is used at a time One brush is dipped 1½" spatted against the inside face of the pail and then used to brush overhead This is continued until the brush starts to leak at which time it is wiped across the edge of the pail until clean It is then hung on the pail with a hook and the work is continued with the second brush

In lieu of a second brush get a child a rubber ball cut it in half punch a hole in the crown side and slip tightly over the brush handle with the *hollow side* facing the bris

Answered By RALPH G. WARING

tles The cup thus formed will stop leakage if wiped out from time to time

REMOVING OLD CALCIMINE

I recently purchased an old New England farmhouse, which I wish to remodel for a summer home The interior walls, while sound, are covered with calcimine or whitewash, but I want to give them an eggshell oil paint treatment How should they be prepared?

This work is best done by two people one of whom uses a pail of warm water containing a cup of vinegar to sponge and wet the surface thoroughly The second person follows within a few minutes and uses a palmetto brush and a pail of water containing one cup of trisodium phosphate powder to loosen and wash off all traces of whitewash A wide putty knife may prove of value in speeding up the work Let all surfaces dry with wide-open doors and windows

Cut out any cracks or dents and repair with patching plaster Dry hard and cut down with No ½ abrasive paper until level and smooth Then proceed to use the eggshell wall paint according to the manufacturer s directions

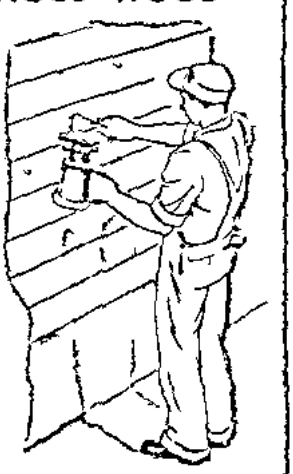
KEEP BRUSHES OUT OF WATER



Recently I read that many painters keep brushes soaking in water when not in use, but isn't this very harmful to the bristles?

Whoever wrote that ought to be fined $50 or given six months in jail! Suspend occasionally used paintbrushes in a mixture of half pure turpentine and half pure raw linseed oil so that the bristles remain straight and hang clear of the bottom of the container by at least 1" Wipe such brushes dry before using They will keep in perfect condition Water, on the other hand makes the bristles soft and flabby

PAINTING RESINOUS WOOD



Here in the south we have trouble with pine resin streaks showing up on our outside trim The paint cracks like an alligator's skin and is now peeling off How can I cure this?

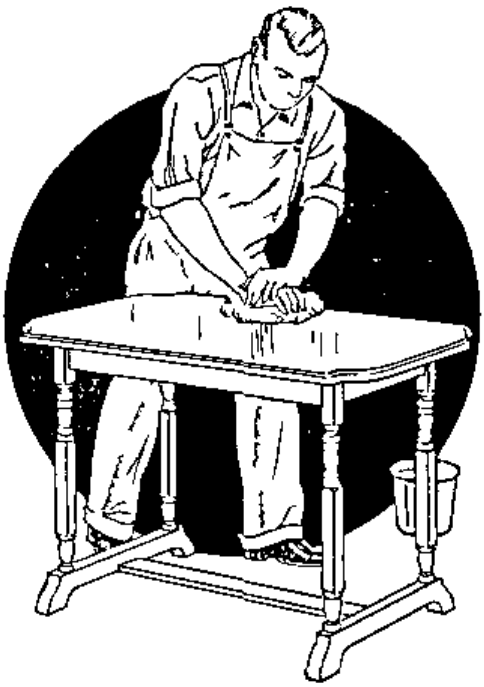
Have a reputable painter burn off the broken-down coats after you have obtained written permission from your fire insurance company to do this work Without this permit you take a chance on having all your fire insurance invalidated

This burning is necessary, first, to remove the old paint, and second to draw out the excess resin from the wood Sand the trim Prime with aluminum bronze of the varnish grade, using 2 lb of bronze in 1 gal of outside spar varnish Wet the bronze to a paste with turpentine before adding the varnish Brush out well dry hard and then give two coats of first-quality paint Sand the first coat lightly when dry

PRESERVING COPPER SCREENS

A previous tenant painted our copper screens black How can I get this off? We live near the seashore, so what should I do to keep the copper from turning green?

Lay the screen down over a sheet of metal or any building board that has been given a coat of hot paraffin to stop absorption Use a heavy bodied or marine-type varnish remover on the screen wire Apply with a slow, flowing motion in one direction only,



WATER USED FOR FINAL RUB

Why do you use wet cotton waste for a final rub after crude oil and pumice stone?

The use of clean white cotton waste or a piece of wrung out cotton flannel to clean up and polish after oil rubbing is a long established practice in the coffin industry This method produces a rich semipolished sheen not obtainable in other ways and removes any stop marks left by the felt rubbing pad Rubbing pads used with oil should never be used afterward with water or they will become hard and glazed If that should happen soak the pad overnight in gasoline and clean with a dry scrub brush

let stand ten minutes test with the finger to see if the finish is cut down to the wire then scrub loose with an ordinary palmetto brush The wire must press against the backing material throughout because copper or bronze mesh is too soft to stand unsupported pressure

Turn the screen over and repeat the process very carefully to prevent springing the wire Give a final wash with another scrub brush and denatured alcohol Clean up the frames as well Let dry overnight then give a light brushing from both faces of outside spar varnish Blow out any places where the varnish has bridged the meshes The metal will not be corroded by salt air

PREPARING A PLASTER WALL

We are planning to wall paper several rooms in our new home, but have been warned that the plaster may be too fresh and that this might cause discoloration or other trouble later on Is there any way to test the plaster?

Before wall paper is hung on a plaster wall it is important that the plaster be in good condition without hot spots caused by excessive lime If in doubt apply a five-percent solution of phenol phthalein which can be obtained at a drug store If this chemical causes a stain to appear ranging in color from pink to deep red the plaster requires to be neutralized before any paper can be safely hung This can be done by using a solution of from 2 to 4 lb zinc sulphate to a gallon of hot water

After the wall has dried it must be properly sized In case the plaster was found to have an excessive amount of lime or is otherwise in doubtful shape it is best to prepare a special size as follows eight parts ordinary commercial wall paper size or glue size one part molasses and one part vinegar Heat stir well and apply to the wall while hot Another point to remember is that whenever a high grade expensive paper is used it pays to apply a lining paper first

RICH STAIN FOR MAHOGANY

How can I give a Colonial mahogany finish to a table I have made?

Usually this is a deep mahogany color of rich reddish tinge First stain the wood brown mahogany let dry and rub with 6/0 garnet finishing paper then apply a coat of red mahogany stain Fill the grain with paste filler tinted red mahogany Apply one coat of high grade four hour floor varnish thinned with an equal amount of turpentine and follow with two or three coats of full body varnish Rub to a semipolish with FFF pumice stone and oil

REMOVING PAINT FROM GLASS

What is the easiest way to remove a painted sign from a window?

Make up a paste of 1 lb of ordinary whiting and a small quantity of water containing all the washing soda it will dissolve Apply this paste freely to the painted letters on the window Leave it on until the letters are quite soft and can be cleaned off with a wad or roll of newspaper

Emergency Work Flag Set Up on Shovel

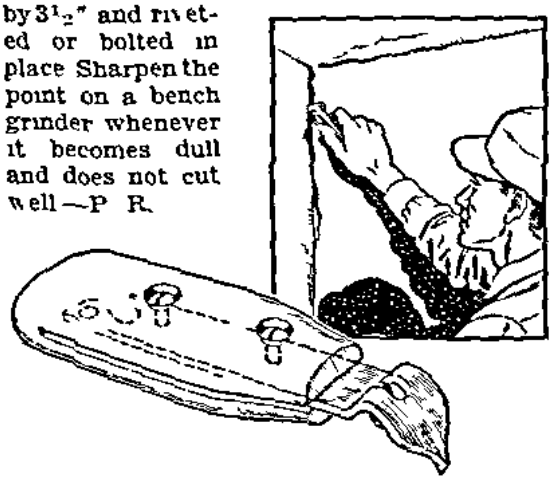
"WARNING" or "stop" flags are easily carried on construction jobs for emergency use if made as shown Short sections of radiator hose, slit open at one side, are attached to the crosspiece and tip of the flag These grip the handle of a long handled shovel which may be stuck into the ground to serve as the supporting staff —G H



The flag is held with pieces of radiator hose

Tool for Cleaning Out Cracks in Plaster

BEFORE patching long, narrow cracks in plaster walls such as those that often occur in the corners of a room or along the baseboard, it is necessary to widen them clean them out thoroughly and undercut the edges a little This can be done quickly and easily with a crack-opening tool made as shown below from an ordinary beer-can opener The handle is shaped from a soft pine block *about* $\frac{3}{4}$" by $1\frac{1}{2}$" by $3\frac{1}{2}$" and riveted or bolted in place Sharpen the point on a bench grinder whenever it becomes dull and does not cut well —P R



A wooden handle is bolted to a beer can opener

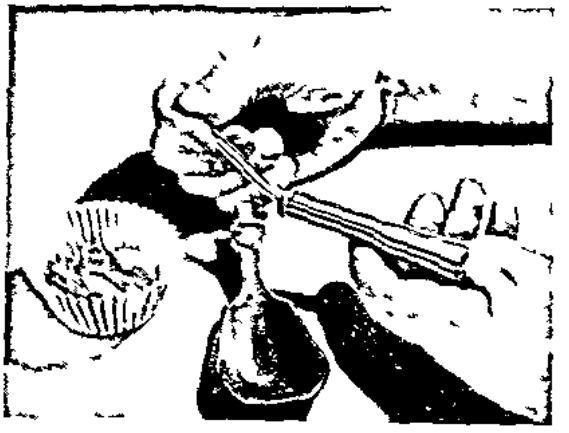
Removing Stamps Quickly

STAMP collectors can remove stamps almost instantly from envelopes without running any risk of damaging them by placing several drops of water so as to form a little pool over the entire surface of the stamp and then *heating the* water with an electric burning or pyrographic pen This quickly softens the mucilage, and the stamp comes off



Casein-and-Whiting Cement Fastens Small Handles

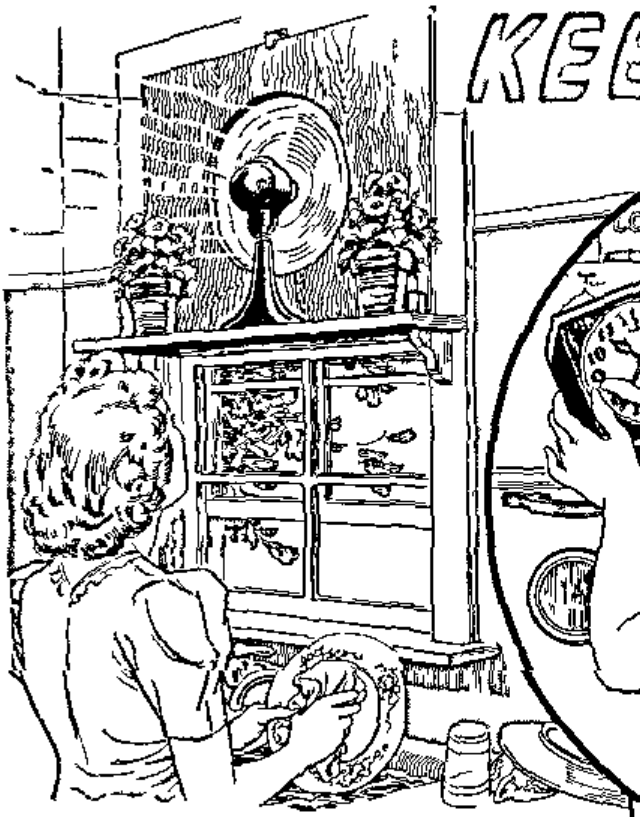
WHEN a knife, tool, or other small implement must be replaced in its handle, a satisfactory and easily prepared cement consists of one part each of waterproof casein glue and whiting The glue gives the compound an adhesive and waterproof character, while the whiting provides bulk and lessens the tendency to shrink —O B



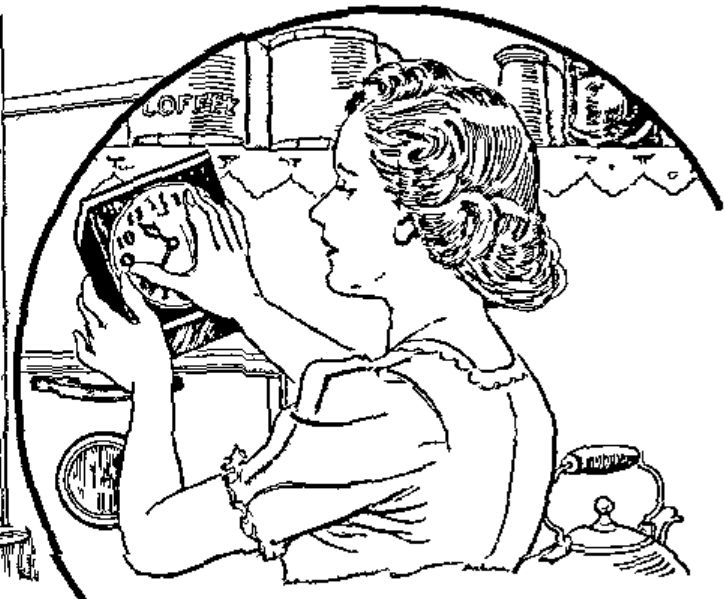
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IF YOU standardize on 12" hack-saw blades of the hand style and make a habit of using the forward 6" until worn, then the remainder of the blade, you will get much longer life out of each blade

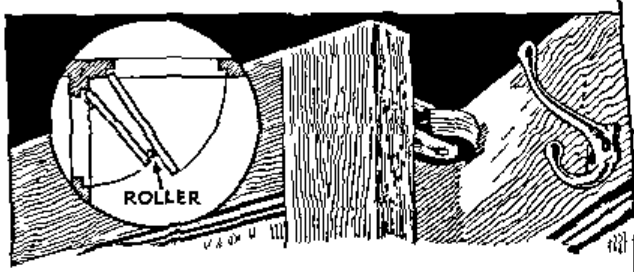
KEEPING THE



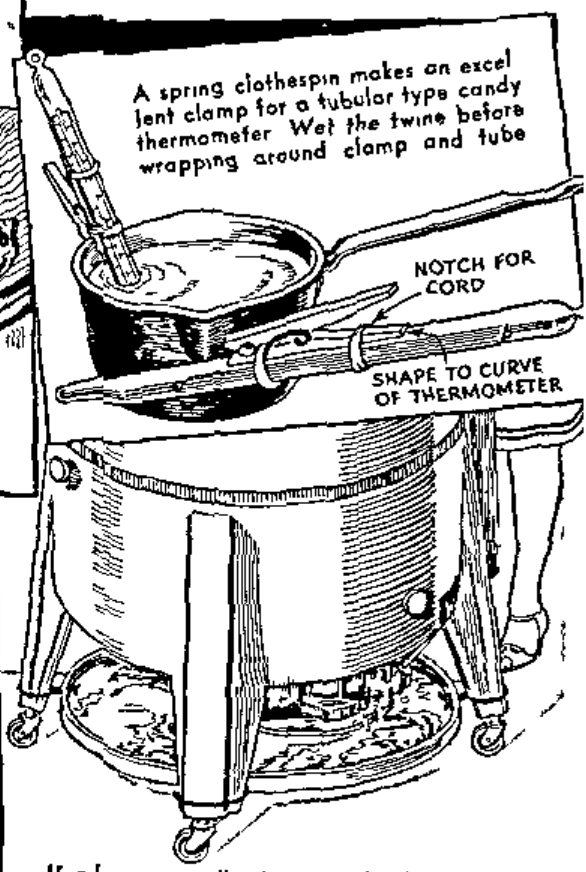
To use an electric fan as a kitchen ventilator set a plywood panel with a hole l larger than the fan diameter between the window trim and a cleat on the shelf A catch holds the panel at the top



As a rem nder of when the cake w ll be done, fasten a piece of tape or gummed paper on the glass front of the kitchen clock and rotate the glass forward the required minutes



When two doors open aga nst each other a small rubber wheel attached to the top corner of one door prevents the knobs from scrap ng the panels



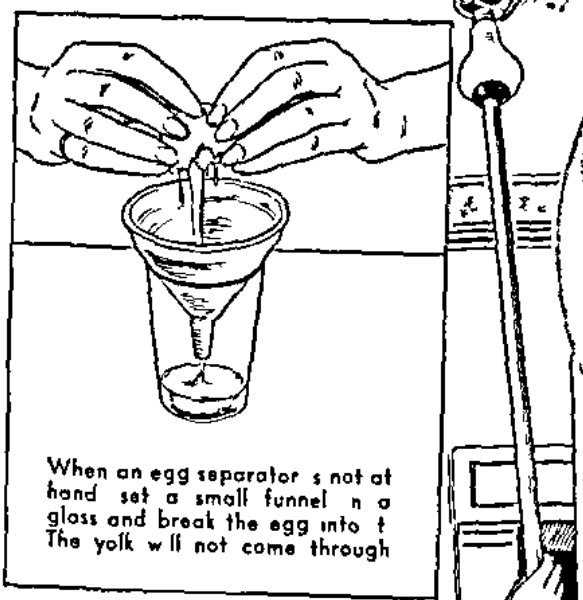
A spring clothespin makes an excel lent clamp for a tubular type candy thermometer Wet the twine before wrapping around clamp and tube



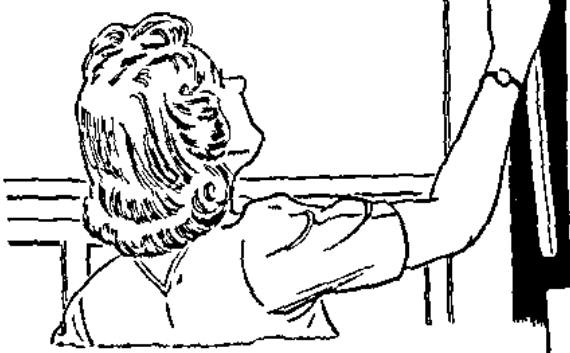
Cellulose base linoleum cement can be prevented from drying and crack ng after it is applied by adding ½ oz. castor oil to 1 qt cement Even after it has dried it may be bent l ke celluloid

If oil occasionally drips on the floor from the motor of your electr c washer w re the metal lid from a large pretzel or lard can to the legs

HOME SHIPSHAPE



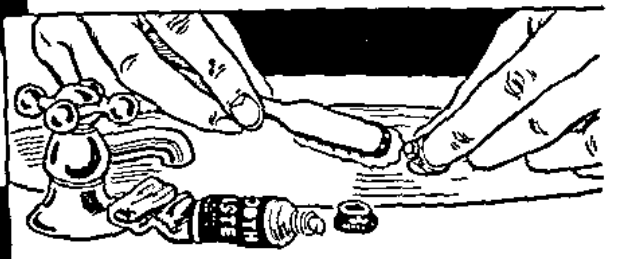
When an egg separator s not at hand set a small funnel n a glass and break the egg into t The yolk w ll not come through



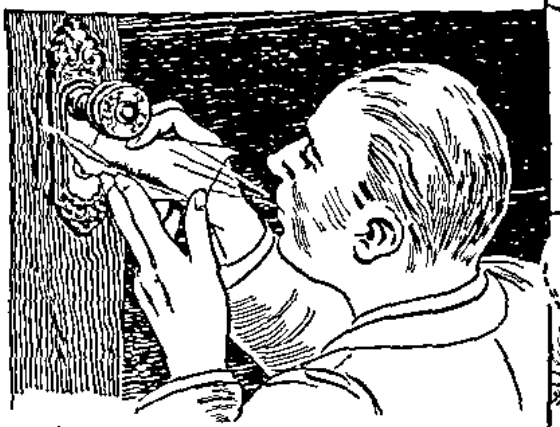
Bulbs n h gh ce l ng f xtures can be removed w th a suct on cup attached to a pole Wet the cup and then press aga nst the bulb f rmly



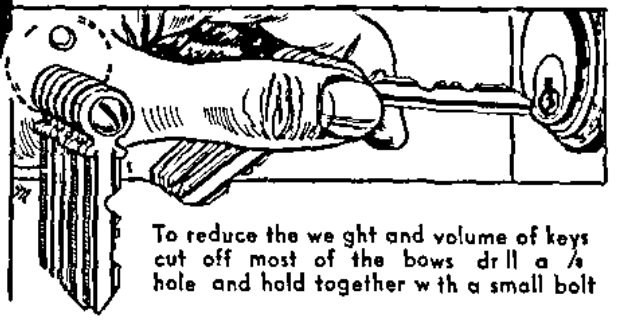
For m x ng paste wh te lead to make pa nt th s paddle is ideal because lumps a e broken eas ly Bore the holes before cutt ng the paddle to shape



Prec ous stones can be cleaned w th tooth paste Apply the paste (any popular brand) w th an old toothbrush and r nse the stone in runn ng water

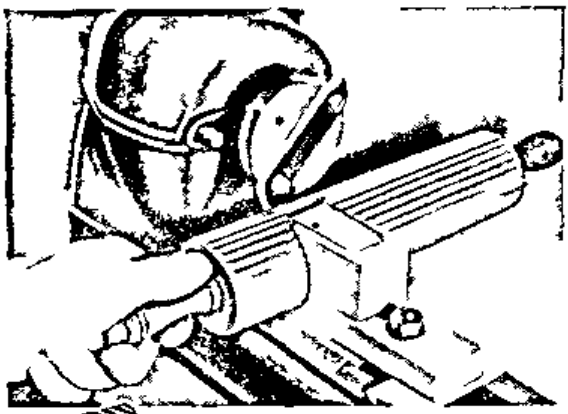


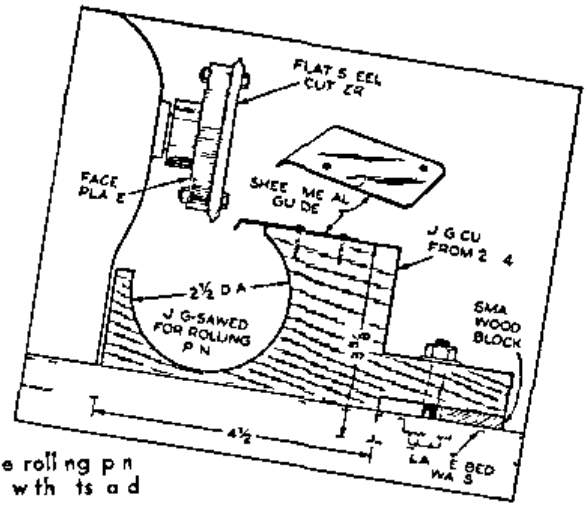
Powdered graph te obta ned from the lead of an o d nary penc l makes a good lock lubricant It may be blown n f no ejector s ava lable

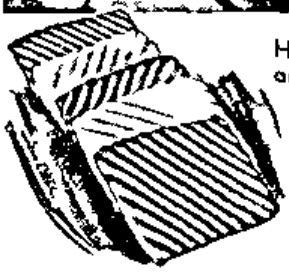


To reduce the we ght and volume of keys cut off most of the bows dr ll a /8 hole and hold together w th a small bolt

Fluted Pin Rolls Fancy Cookies





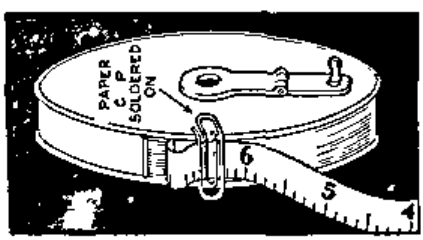


How the flutes are cut in the rolling pin and left cookies prepared with its aid

FANCY cookies are easily prepared with a fluted rolling pin The one shown is an ordinary rolling pin $2\frac{1}{2}$ in diameter which was fluted with a cutter made from a piece of flat steel $3\frac{3}{4}$" by $\frac{3}{4}$ by $\frac{1}{4}$ The ends were ground to the shape shown and the cutter was mounted on the faceplate of the lathe A jig to hold the rolling pin in position under the cutter was cut from a piece of 2" by 4 stock. Note the sheet metal guide attached to the top of the jig One end was bent over so it would fit in a groove already made and assure even spacing

A line was marked along the pin for the first groove The lathe was started and the pin pulled forward slowly as the cutter ploughed out the groove The other grooves were automatically spaced by the sheet metal guide

For best results in making cookies a very short dough with little or no leavening should be used —BENJAMIN NIELSEN

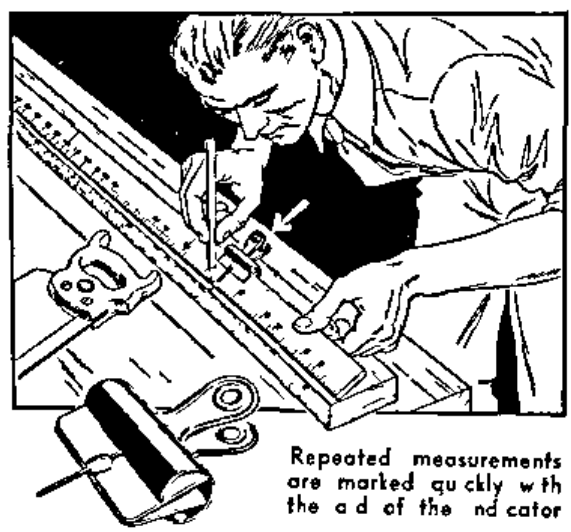


Clip Keeps Tape from Unwinding

TO APPLY a restricting brake on your tape line and prevent it from unwinding too easily and tangling bend a wire paper clip at a right angle and solder it on the side of the reel box It is an easy matter to slip the tape under the clip and hold it at any desired length

Foolproof Length Gauge Clamps on Yardstick

FOR marking lengths or transferring measurements when cutting wood stock I find it easier faster and more accurate to use the sliding indicator illustrated It is a common spring paper clip to which a slender brad has been soldered The indicator can be clamped over a yardstick or any thin strip of wood Three or four of the clips may be set along a rule or stick when you wish to record several measurements Where inside measurements have to be made and you must telescope two shorter sticks these form handy non slip clamps —RALPH C COX.

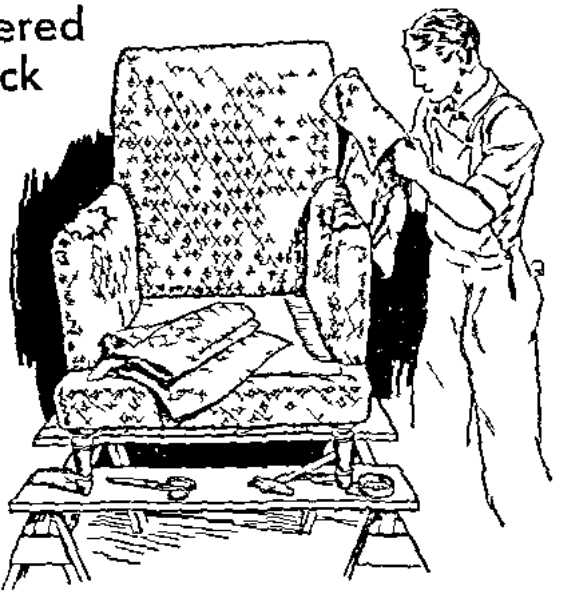


Repeated measurements are marked quickly with the aid of the indicator

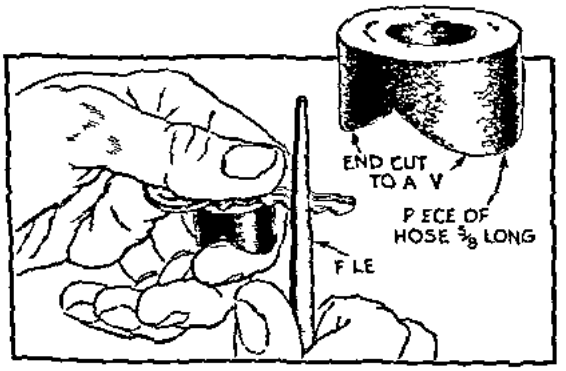
Arms of Easy Chair Re-Covered with Cloth Taken from Back

WHEN the cover material on the upholstered arms of your favorite armchair has worn through while the rest of the chair remains in good condition you do not necessarily have to go to the expense of re-covering the entire chair Almost always the rear of the chair back is covered with a large panel of the same material and this is enough to re cover both arms

First a narrow fold is turned to provide a strong finished edge which is fastened with gimp tacks along the outside under edge of the arm roll Next turn the piece of cloth up over and down the inside surface of the arm Carefully fold and fit it over the front end of the arm and tack down along the rear outside edge of the vertical part of the arm After the cloth has been pulled down smoothly the lower inside edge is stitched to the original covering and the back edge is tucked into the space where the arm meets the chair back



A piece of cloth of suitable color is afterwards tacked on the chair back where the original cloth was removed —H O BUMANN



Short Section of Hose Used as Finger Vise

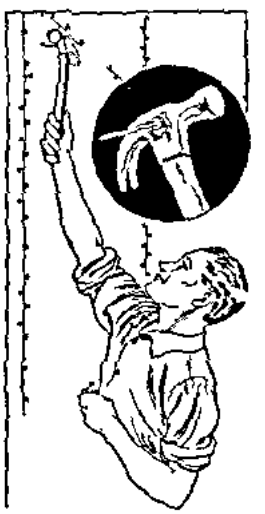
MANY small flat pieces that have to be shaped or finished by filing can be most conveniently held in the fingers with the aid of a section of air hose or heavy water hose about 5/8" long Cut a V into one end of the tubing to fit over the tip of the fore finger as shown above —F B

Keeping Dial Phone in Place

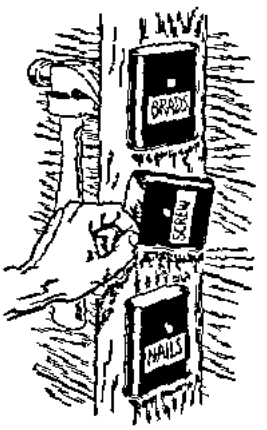
DIAL telephones have an aggravating habit of slipping on a polished desk when you are dialing thus turning a one finger job into a two handed one Mine used to do this until I brushed a little paper cement (white rubber cement) on the felt on the bottom Now the phone stands as if bolted to the desk —E C BROWN

Nails Stuck to Hammer for Starting

A GOOD trick for starting nails where it is inconvenient to hold them is to rub a little belt dressing on the side of the hammer head The nailhead adheres to this sufficiently to remain in place for the first blow with the hammer held sideways



Nail and Screw Holders



TO KEEP odds and ends of nails and screws at hand in a barn garage or workshop cut the tops from a number of tobacco cans and nail these onto the side of any studding Place the supporting nails somewhat above the middle of the cans The contents are made accessible by tipping the cans forward



Tiny Articles Soldered by Using Hot Wire

VERY small articles such as tiny links of white metal costume jewelry can be soldered neatly with ordinary soft solder as shown above The 14 gauge copper wire takes the place of a soldering iron and the heat is regulated by moving the Bunsen burner When the end of the wire is hot soldering paste is applied and a warmed piece of wire solder is touched against it so as to leave enough for joining the parts —F D M



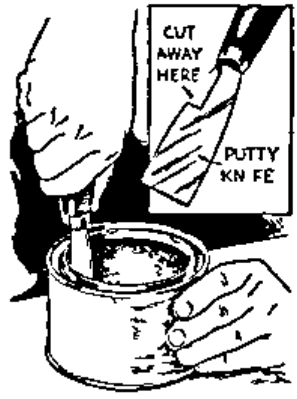
Percolator Serves as a Gluepot

A DISCARDED elec tric coffee perco lator can be used as an electric glue pot Place the in ner part of an ordi nary gluepot in the open top of the percolator to hold the glue The water heats it quickly

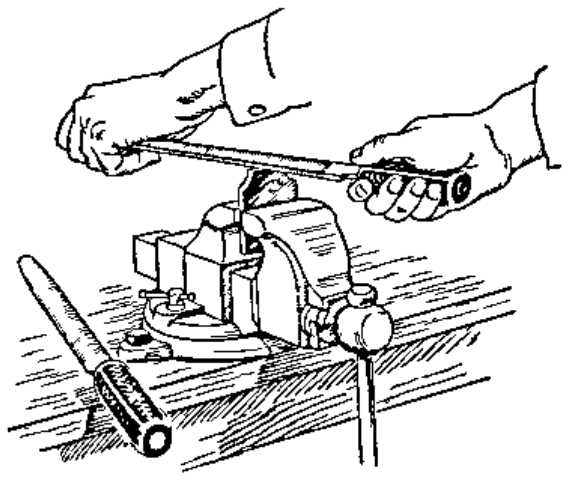
Repairing Rusted Feet of Old Laundry Tubs

WHEN the angle iron legs of laundry tubs rust away at the base scrape all the scale off place a conical sheet metal mold around the leg clamp it shut and fill with molten lead as at the right Then strip off the mold In some cases it may be necessary to drill holes in each of the tub legs to provide a strong key for the lead —HOWARD LEWIS

Putty Knife Is Altered for Scraping Cans

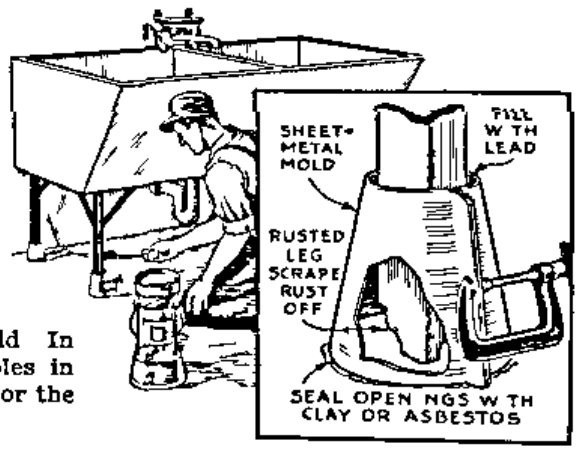


REMOVING the con tents of the com mon type of small paint can or any can having an edge turn ing inward will be easier if you cut or file away part of an ordinary putty knife near the handle as shown in the sketch above The knife reaches into every corner It is also a handy implement for mixing the can s contents —STAN HUGO



Rubber Handles Improve Files

RUBBER bicycle pedal treads obtainable from a bicycle supply store or taken from an old bicycle pedal make excellent file handles that will not come off in use yet can readily be removed The rubber is sufficiently flexible so that the file can be held easily in unhandy places and is less tiresome to grip —KOUDY KENNON





By
HI SIBLEY

•

These fine goggles were made by a Hawaiian Experts consider this type *more satisfactory* for serious diving and continuous use than the ordinary rubber variety

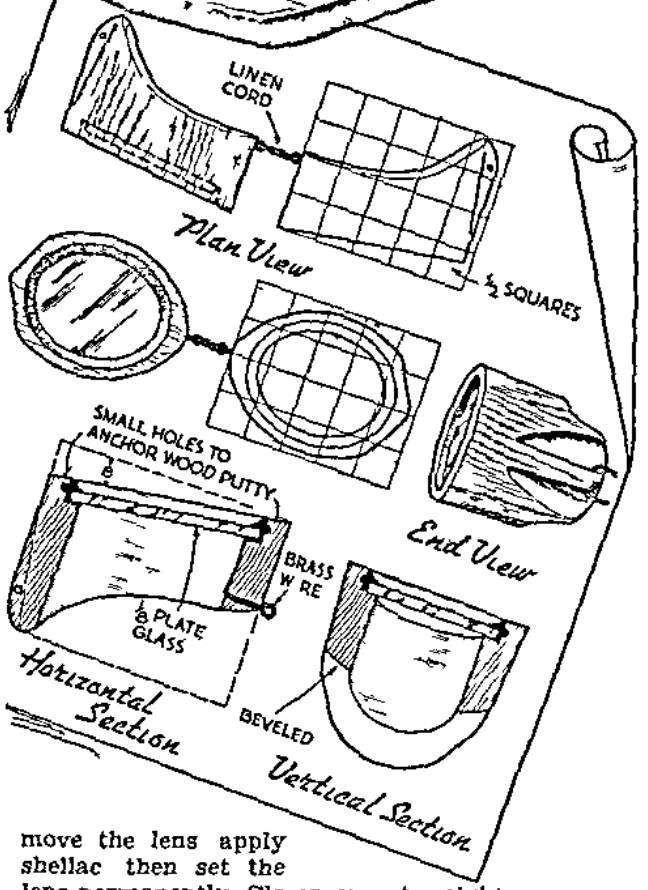
SOUTH-SEA Diving Goggles

WITH a little care and patience you can construct diving goggles exactly like those used by the spear fishermen of the South Seas and expert Hawaiian divers

Any nonporous hardwood not likely to split may be used but it must be thoroughly seasoned The goggles shown in the photographs were carved from hau (pronounced how) a wood available in Hawaii

Cut two blocks 2 by 2" by 2½" and bevel the front surface of each on an angle of about 8 deg Then bore and file out the openings as shown Carve a rabbet or seat for the lenses which are plain plate glass about ⅛" thick Any glazier will cut these for you In making the seat try to get as perfect a fit as possible By coating the lens with lampblack and pressing down on the seat high spots will be revealed Do not mount the lenses until the outside of the wood is shaped to its final form and the small brass eyes for the cord have been inserted in their holes and clinched inside

Apply shellac on the lens seat then a thin layer of plastic composition wood Press down with the lens to smooth the paste Remove the lens apply shellac then set the lens permanently Clamp or put weights on the lens to hold it firmly until the shellac dries Finally apply composition wood around the edges on top as shown If



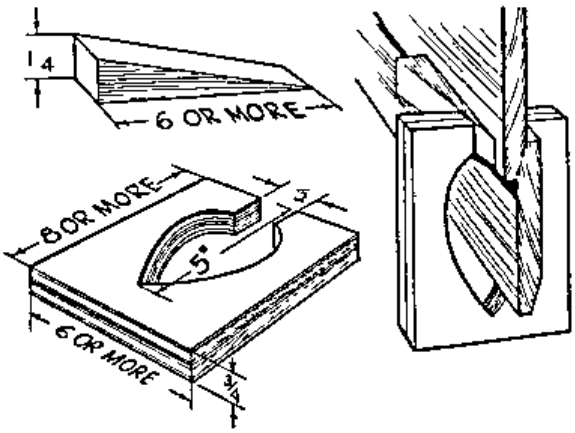
small shallow holes are first drilled around the inside they will serve to anchor the plastic material more firmly

The rim that fits around the eye should be beveled carefully so that the pressure will be equal all around The flesh will yield enough if the wood is properly fitted to form a watertight joint Give the wood two or three coats of shellac all over

To prevent fogging in use soak the goggles in water of the same temperature as that in which they are to be used Wet the skin around the eyes and press the goggles on to create a partial vacuum inside This will make the eyes feel a bit queer but does not hurt The proper spacing of the two members can be determined by experiment.

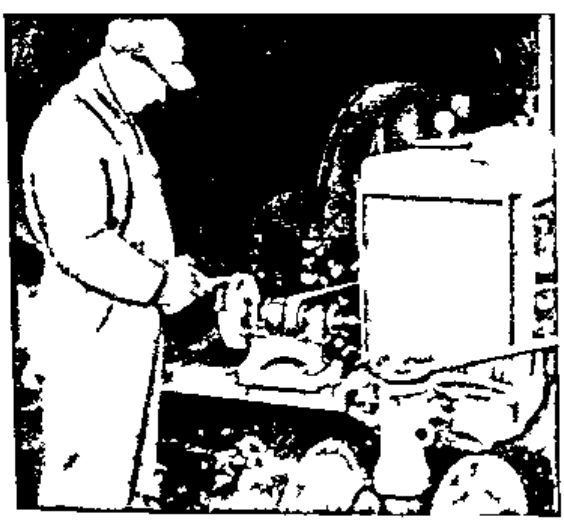


A fairly tight rubber band keeps the goggles on



Boat-Planking Clamps

IF YOU do not have enough large screw clamps to hold the planks while fitting and riveting a small lapstreak boat make up a dozen wedge clamps from two layers of ⅜" plywood as shown above The inner portion of the jaws is sawed larger so the clamps can be used on curves —J W RANKIN



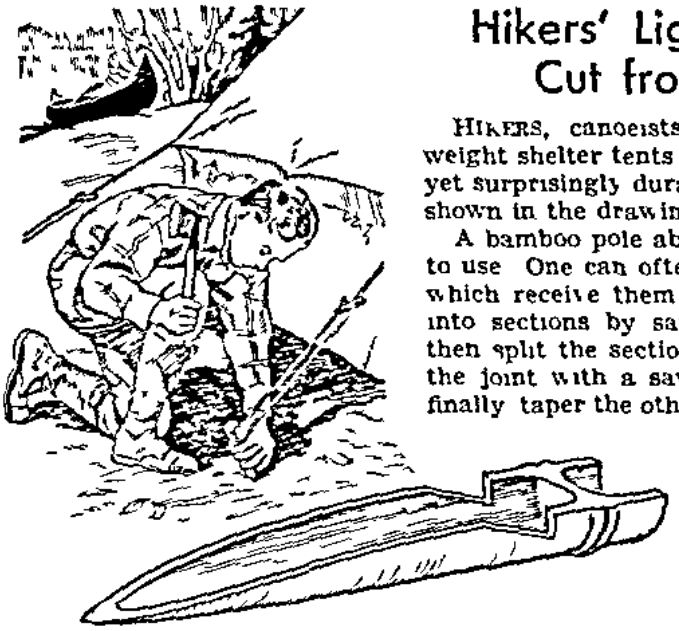
Radiator Hose Used as Golf Practice Ball

A 2 PIECE of 1¾" radiator hose may be used for practicing golf shots either indoors or outdoors with all clubs except the putter When hit it gives about the same feel as a golf ball and it reacts to the way it is hit much as a regular ball does A perfectly hit shot will make it fly true and straight, whereas a poorly hit one causes it either to hook or slice If hit underneath it pops up and topping will make it skitter over the ground for some distance —LOUIS R. JAFFEE



Grinder Set on Tractor to Sharpen Farm Tools

ONE farmer attached a grinding wheel base to his tractor as shown at the left This required but little more labor than squaring the end of a block of wood to fit one of the regular sockets provided for attaching cultivating equipment Powered from the belt pulley of the tractor the grinder is useful for putting mower knives cultivator shovels and plowshares in good condition as well as for other odd jobs ROYCE M ROATH



Hikers' Lightweight Tent Pegs Cut from Bamboo Poles

HIKERS, canoeists, and cyclists who carry featherweight shelter tents on their trips can make a very light yet surprisingly durable set of tent pegs from bamboo as shown in the drawing at left below

A bamboo pole about $1\frac{1}{4}$" in diameter is the best size to use One can often be obtained from furniture stores, which receive them in shipments of rugs Cut the pole into sections by sawing about $1\frac{1}{2}$" above each joint, then split the sections in half Start the notches below the joint with a saw then cut them out with a knife, finally taper the other end If bamboo smaller than 1" is used it is best not to split it, but to use the material in the full round at the head

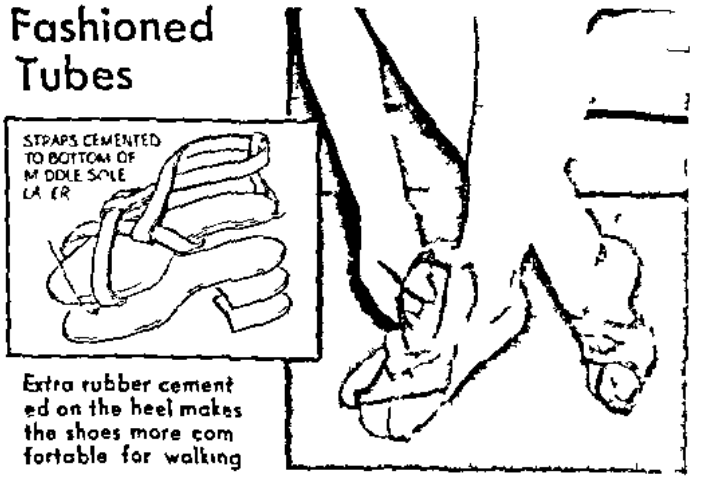
Each bamboo stake weighs but a few ounces and the whole set adds very little to the weight of the pack —CARROLL E BRADBERRY.

Shoes for the Beach Fashioned Out of Old Inner Tubes

BATHING shoes for walking on scorching beach sand are easily made from a discarded automobile inner tube

Draw the outline of each foot on cardboard and use it as a pattern in cutting the sole Each sole is made of three thicknesses of rubber The crosspieces are cemented in place with rubber cement after two thicknesses of the rubber sole have been cemented together The length of the crosspieces is best determined by placing them across the foot in their position

The back part of the shoe is anchored by cementing a short loop to the heel as shown A rubber strap passes through this, crosses in front of the foot, and is attached to the crosspieces —FRANK CAPORAEL.



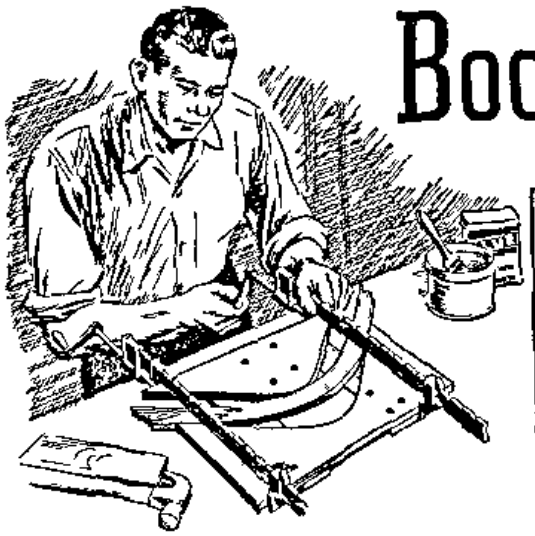
Extra rubber cemented on the heel makes the shoes more comfortable for walking

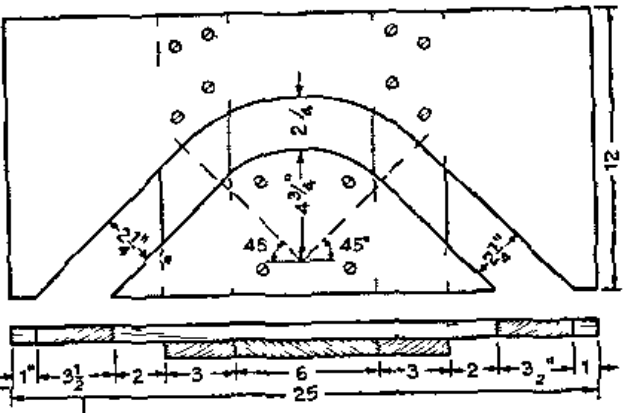


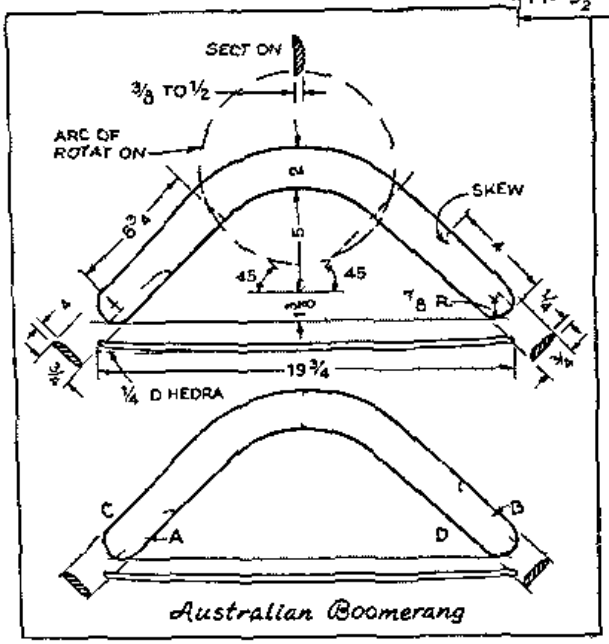
Vine Awning Changes with the Seasons

WHEN the cloth on one of our awnings needed replacement, I covered the framework with $\frac{1}{4}$" mesh hardware cloth and allowed a climbing vine to cover the screen completely This awning may be called "automatic" because it changes with the seasons, growing dense in the summer and practically disappearing in the late fall when the leaves drop off It does not, of course have to be taken down —A. J VIKEN.

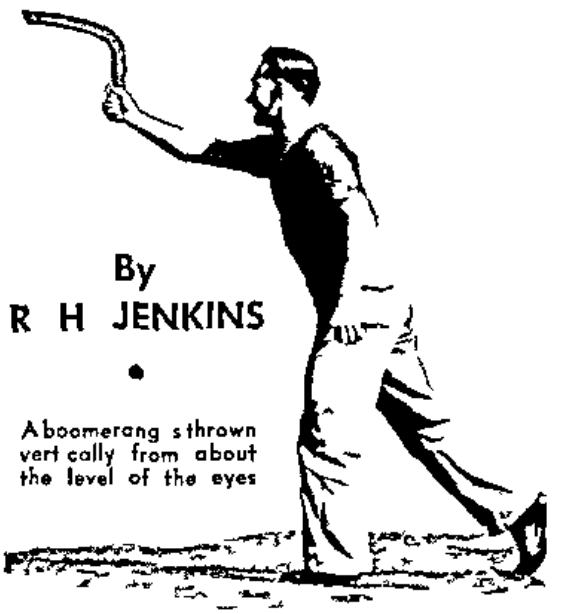
Boomerangs...How





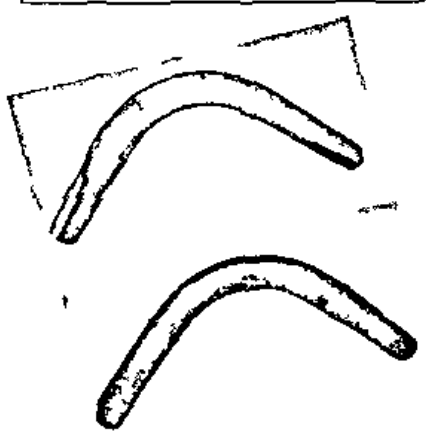


Australian Boomerang



By R H JENKINS

A boomerang s thrown vert cally from about the level of the eyes



Flat and rounded s des of a boomer ang made by glu ng up th n str ps n the j g shown at top of the page

IT S GREAT sport to throw the Australian bushman type of boomerang but its construction has always been a problem because of the d fficulty of bending the wood A simple solution is to glue up the boom erang from a number of layers of thin wood in a form or j g made as shown above

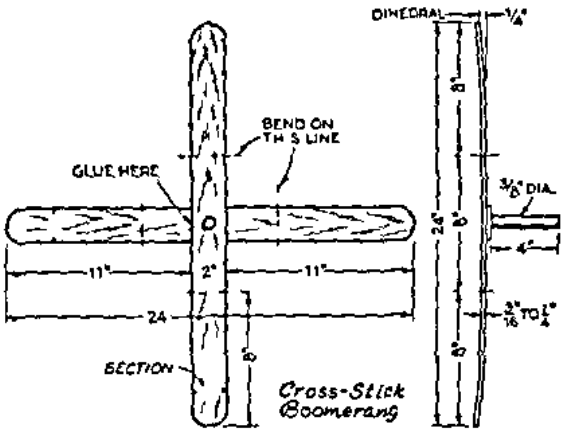
Any wood will do for the j g but be sure that the two curves are parallel when they are 2½" apart For each boomerang cut eighteen pieces of oak or maple ⅛" by ⅝" by 28" Apply waterproof casein glue on each piece clamp the whole mass in the jig and let dry

Plane the bottom smooth cut out the shape and round off the top to about ½" maximum thickness in the middle and ¼" at each end Bend up both ends by heat ing the laminated wood on top at the 6¾" points and bending toward the heat this gives the required dihe dral angle or upward bend of about ¼ Skew off with a spokeshave the points marked *A* and *B*—from 1/32"

to Make and Throw Them



The cross stick type is even simpler to make It can be caught upon its return by means of a handle



to 1/16" should be enough For a left-handed person, the points must be reversed and the corners taken off are then at *C* and *D*

Throw vertically, never horizontally, and at about the level of the eyes Hold the boomerang at end *B* unless you are left-handed, in which case hold it at end *C* Be sure to keep the curved face in toward your body The throwing should be on soft ground

The cross stick type of boomerang is still easier to make Rip out two strips 3/16" or 1/4" by 2" by 24' Find the center and glue together into a perfect cross. With the spokeshave, round off the top of each segment, working it thin on the edges but leaving the middle flat Round off the ends, and bend up to get the dihedral angle from a point about two thirds of the distance from the end to the middle

A 3/8" dowel, 4 1/2" long, may be used in the middle, but not glued, as an aid in catching the cross stick boomerang Don t attempt to catch the other type

The first boomerang described could be made of alternate strips of mahogany and maple to give an inlaid effect, if desired.

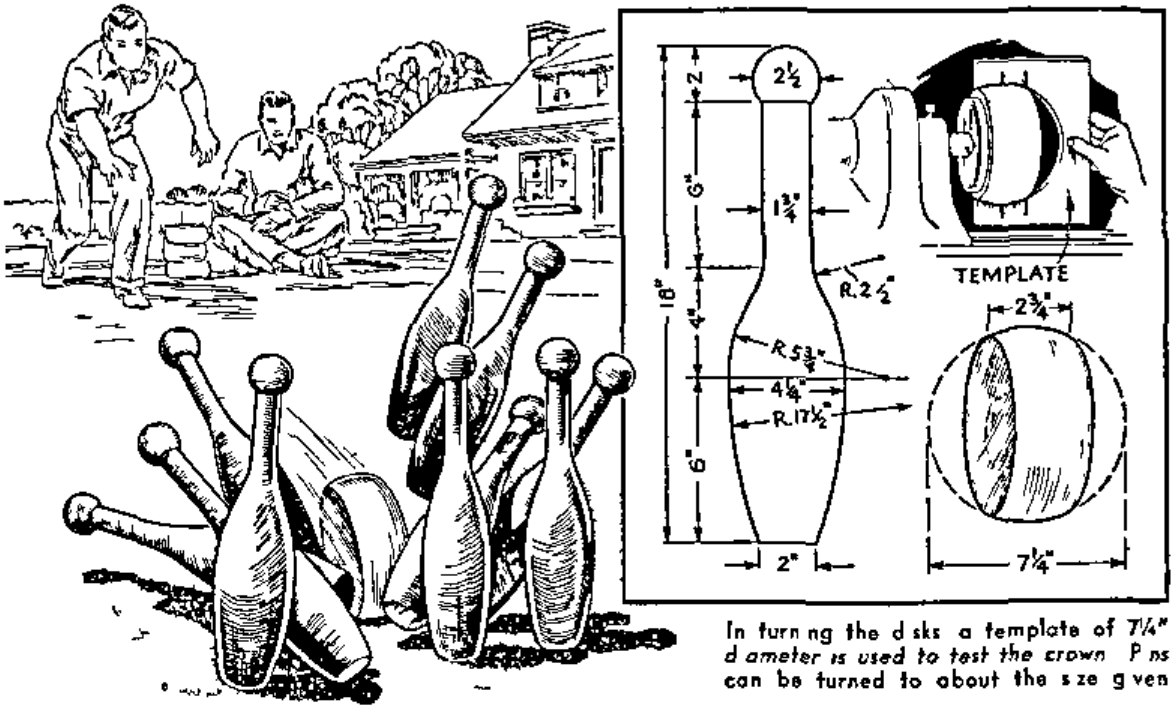
Swing Holds Up End of Heavy Sand-Sifting Screen



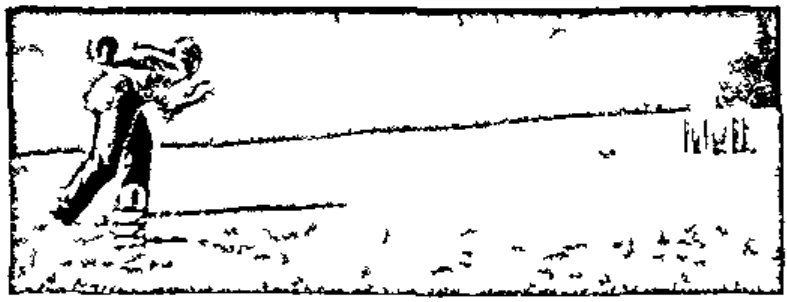
While being filled the screen rests on the barrow. Sifting is done as at right

SAND and gravel can be easily screened by one person with a regular two-man screen if one set of handles is placed in a child s swing as shown While the screen is being loaded, the other end may be placed on anything of convenient height, such as the front edge of a wheelbarrow The coarse material left on the wire mesh can be emptied into the wheelbarrow by upending the screen. —J. D. STAGGS.

Lawn Bowling with Wooden Disks



In turning the disks a template of 7¼" diameter is used to test the crown Pins can be turned to about the size given



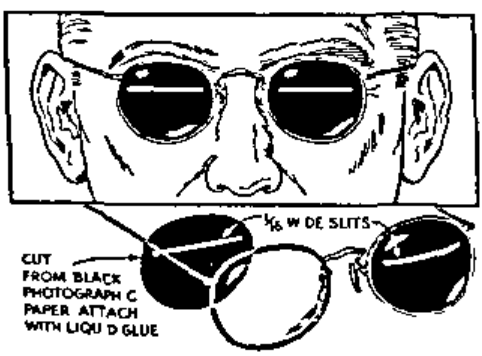
For bowling at home the disks are an inexpensive substitute for balls

THIS improvised bowling set which can be made in an evening or two can be used on either a well mown lawn or a smooth basement floor It provides an inexpensive way to enjoy the sport of bowling

If a number of old Indian clubs can be obtained they will serve as the pins Sometimes discarded clubs can be picked up for little or nothing at a gymnasium As a rule however it will be necessary to turn the pins on a lathe They can be turned to about the size and shape shown in an accompanying drawing but the dimensions may be changed if necessary to fit the available material Hardwood is better for the work but soft may be used

Each ball is made from a disk cut from 3" by 8" stock. The edges are turned to form a circular arc just as though each piece represented a part of a real ball A template should be cut from thin wood to test the accuracy of the turning

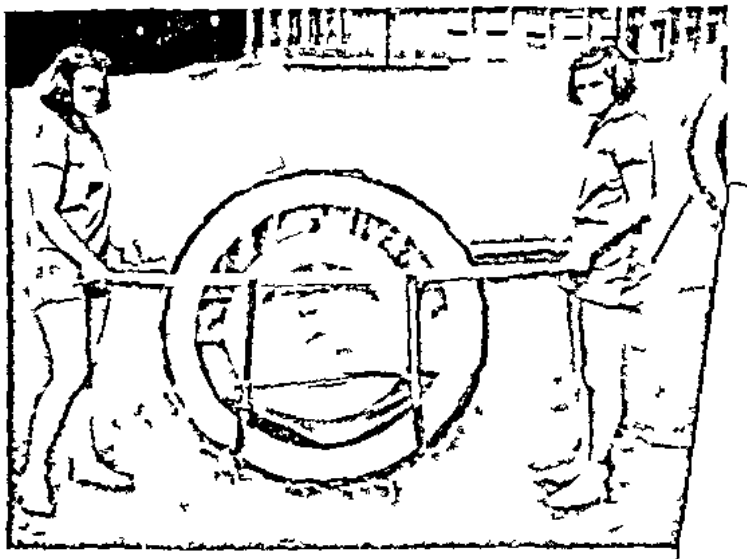
The bowling may be done with ten pins or played like the regular game of bowling on the green —R. J



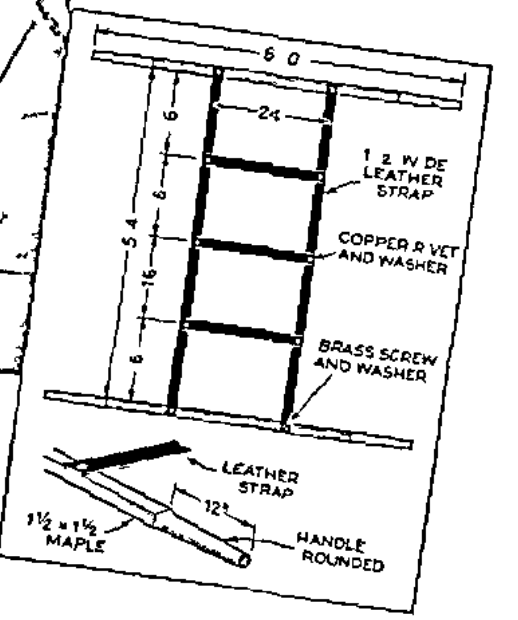
Sunglasses for Emergency Use

THOSE who regularly wear spectacles can convert them into efficient sunglasses when necessary by the method illustrated This idea has long been employed by the Eskimos to prevent snow blindness It is an invaluable expedient when one is exposed to brilliant sunlight and eye searing reflections on a fishing trip at the beach or in the snow and has had no opportunity to provide regular sunglasses The spectacles continue to give the necessary optical correction —J E H.

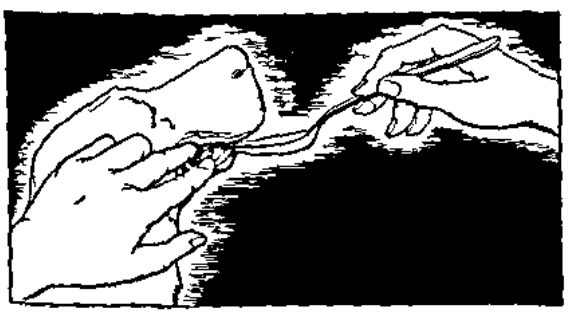
Archery Targets Easily Carried on a Stretcher



Two persons can carry a heavy target The leather harness s attached to the wood as shown at r ght



STANDARD archery targets which are quite heavy can be carried easily in a stretcher made as shown The handles are two pieces of 1¼" square maple 6 long the ends of which are shaped round for about 12" so they will not hurt the hands Two pieces of leather of harness thickness 67" long and 1½" wide are fas tened to the bars with 1" No 8 roundhead brass screws and washers at points 12 on each side of the center Three 24 long pieces of leather of the same thickness are spaced equally apart along the 64 lengths and fastened with flathead copper rivets and washers Sandpaper and stain the bars if desired then give the wood a coat of shellac or varnish —LESLIE D WILDING



Giving Liquid Medicine Safely to a Dog

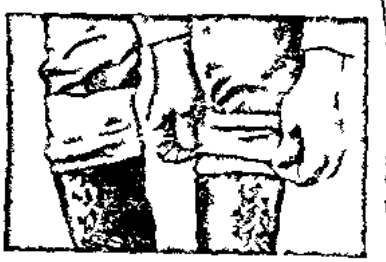
THE easiest and safest way to give a dog liquid medicine is to pour it either from a spoon or a vial into the corner of the mouth The dog s head should be held at an angle of about 45 deg and the first and second finger of the left hand used to part the loose flews at the corner of the mouth Pour the medicine into the pocket so made The head then can be gradually tipped back while the jaws are being held shut This will cause the dog to swallow the medicine naturally —W H FOSTER

Knee Bands Repel Briers

HUNTERS campers and hikers know how annoying it is when briers catch on the part of the sock that overlaps the top of the boot or get into the boot itself To prevent this cut two bands of inner tube 3" or 4" long clean them thoroughly and slip one over each boot pulling it up until half the rubber extends beyond the boot and covers the overlapping sock —JAMES E POLISSO

The band of rubber fo ms a flex ble and comfortable seal between the boot and the leg

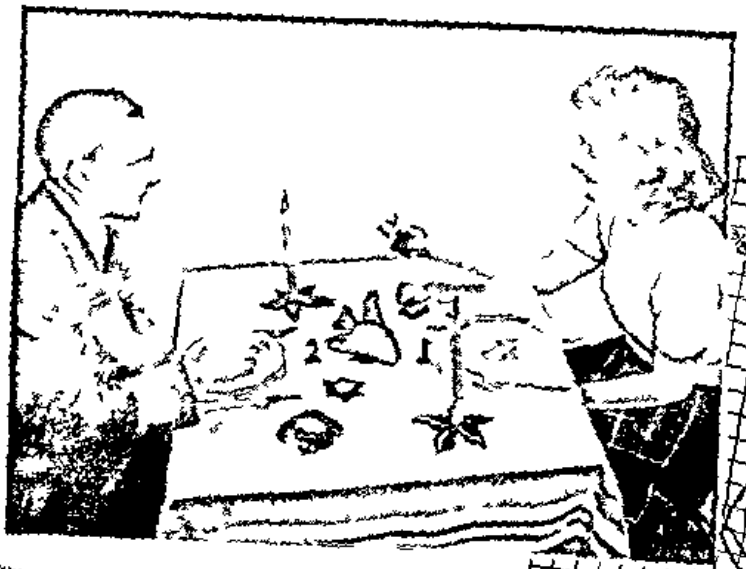


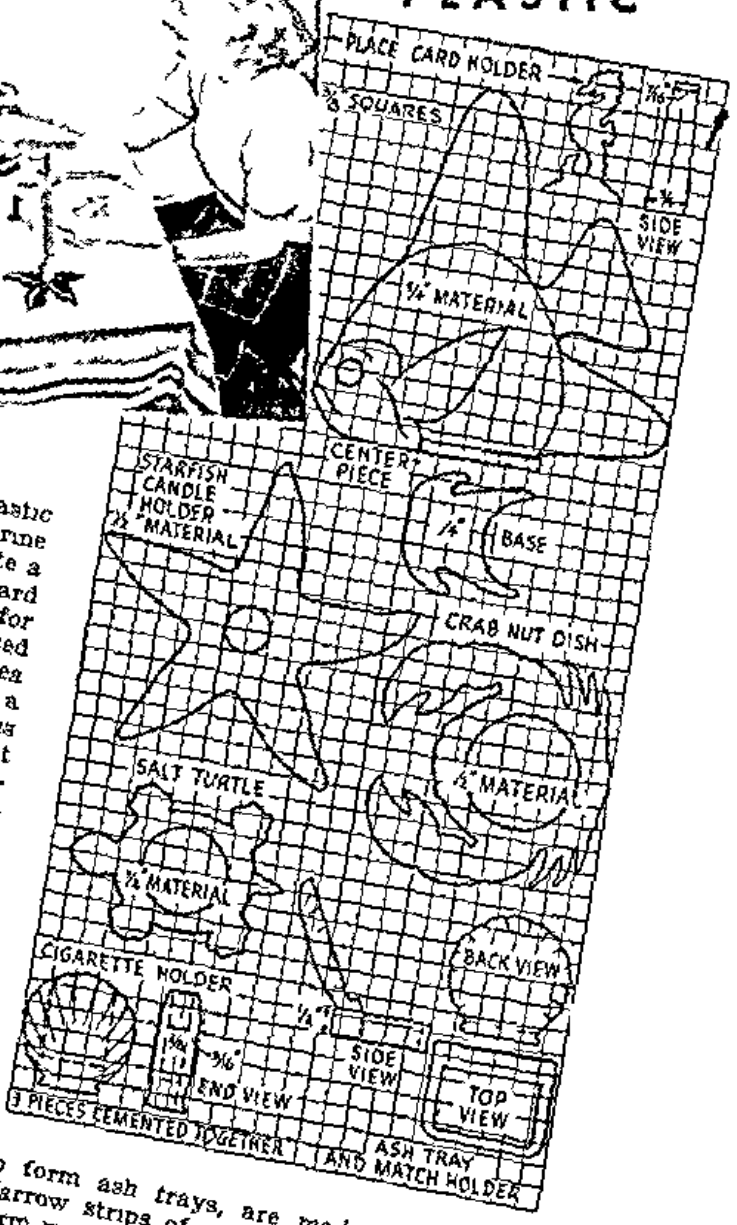




Marine Luncheon Ensemble

IN RICH BLUE PLASTIC



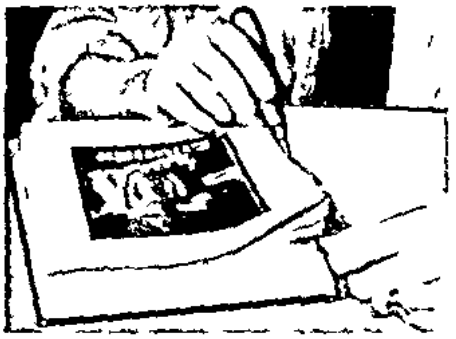


RICH LOOKING, gemlike blue plastic material is used for this novel marine ensemble. It is intended to decorate a table for two but if additional place card and salt holders are made it will serve for as many guests as desired. Conventionalized starfish serve as the candleholders, sea horses hold place cards in their mouths, a baby turtle carries salt, a crab's back is filled with salted nuts, cigarettes sprout from a scallop shell container, another scallop shell guards an ash tray and match holder, while a modernistic fish forms the centerpiece. The designs are from the Metropolitan Junior Achievement, New York.

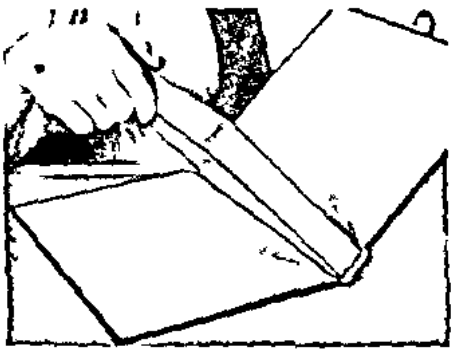
All shapes are cut out with a jig saw, then carved with a hand motor tool if available. Candleholders, place-card holders and salt and nut holders are each made in a single piece. The centerpiece has a base representing wave ripples, fastened on with strong liquid glue or, better still, the special cement supplied by the plastic manufacturer. The combination ash tray and match holder is made in two pieces, cemented together as shown. The cigarette holder requires three pieces. Polishing is done as outlined in previous articles of this series. Cups to fit the nut and salt holders, and to form ash trays, are made of pewter. Narrow strips of pewter are first bent to form rings, then the bottom pieces are cut out and soldered onto them with very soft, low melting solder.

POPU

Leather Album Converted into Stationery Box



With a sharp knife, all the pages are cut away so only the back and covers remain



Make a suitable wooden frame and glue it to the back and bottom cover of the book



OLD-FASHIONED photograph albums or large leather covered books can be converted into attractive boxes for stationery, candy, trinkets, and the like at practically no cost.

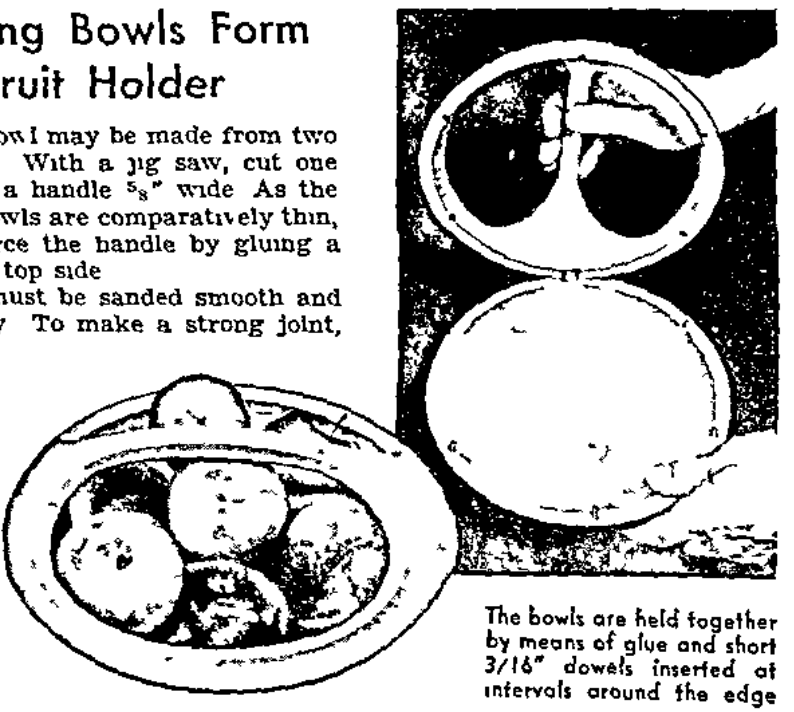
Measure the length, width, and thickness of the leaves only (not the covers) From these dimensions make the four sides of the frame or box from 3/16" soft pine or basswood strips Have the strip along the back slightly wider than the other sides

While the glue on the frame is setting, cut all leaves except the flyleaves (if any) away from the covers Fit the frame into the cover, and glue the back and the lower edges in place. Glue a strip of cloth along the inside edge where the cover hinges *on the wood frame The outside edges of the box* are painted with gilt and then given a coat of dull varnish —J. W. C

Altered Chopping Bowls Form Attractive Fruit Holder

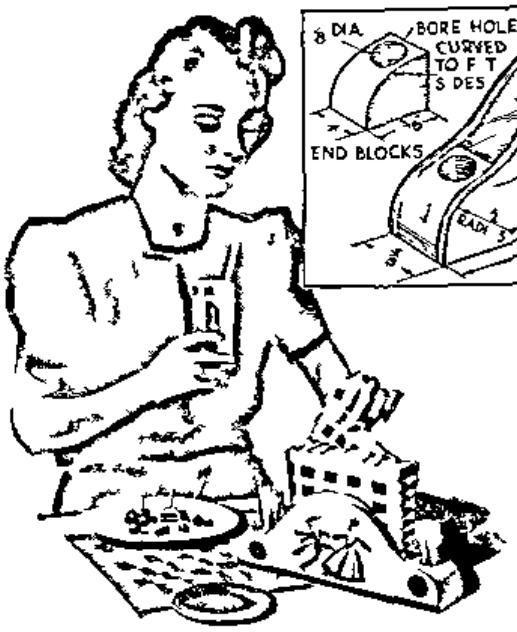
AN ATTRACTIVE fruit bowl may be made from two maple chopping bowls With a jig saw, cut one bowl out as shown, leaving a handle $^{5}/_{8}$" wide As the bottoms of most chopping bowls are comparatively thin, it is a good idea to reenforce the handle by gluing a small strip of maple on the top side

The edges of the bowls must be sanded smooth and flat to fit together perfectly To make a strong joint, short 3/16" dowels are inserted and glued in holes drilled at intervals around the edges of both bowls Rubber bands cut from inner tubes may be used to hold the bowls together while the glue sets. Then remove the bands and give the edges a thorough sanding Two coats of flat-drying varnish give a soft finish.



The bowls are held together by means of glue and short 3/16" dowels inserted at intervals around the edge

Colorful Table Novelty Holds Paper Napkins



THIS gayly paint ed napkin set lends added color to a re freshment table or tray when snacks and titbits are served It holds a supply of small square folded paper napkins and colored toothpicks for spear ing *hors d oeuvres*

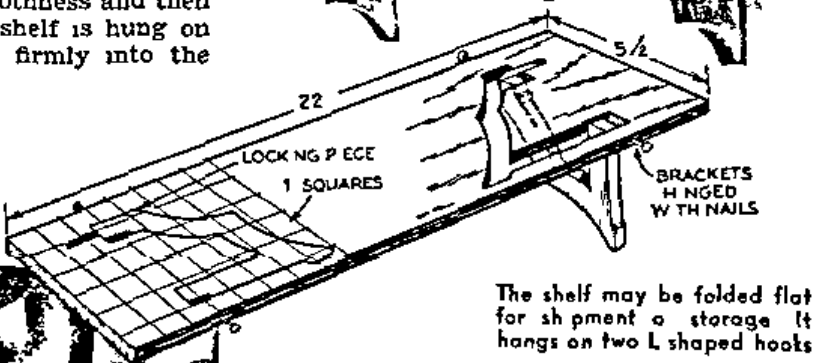
The two plywood sides 3/16" thick are tacked together and scroll sawed at once The bottom is ¼" plywood 11¼" by 8" The end blocks are maple To avoid split ting them they were first bored with ⅞" holes as shown then cut off Assemble with brads sand with No 0 garnet paper and paint any desired color Transfers or hand painted decorations can then be added in any style preferred The holder shown is painted pea green —BRUCE MACINTOSH

Portable Shelf Contains Its Own Brackets

ONE p ece of w alnut 5½" by 22" furn shed the mater al for this port able shelf w hich folds flat for shipment or storage After being jig sawed as shown the brackets are hinged with nails The heads are cut off and the nails driven below the surface so that the holes may be con cealed with slivers of w alnut w hich are glued into place and sanded smooth.

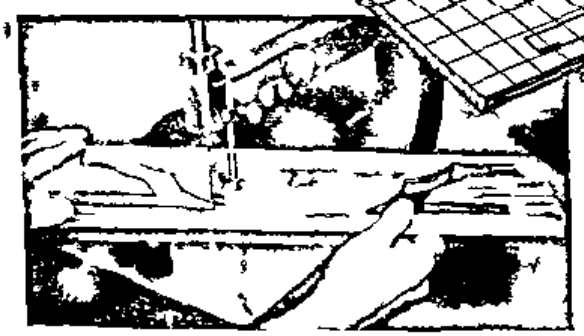
Note that the brackets are designed so that they can be locked in the open position by means of two small locking pieces All surfaces are sanded to smoothness and then fin shed with shellac The shelf is hung on L shaped screw hooks set firmly into the wall —FRANK WHEELOCK





B ackets and she f a e g sawed f om one p ece Note the ngen ous lock fo hold ng the b ackets n pos t on

The shelf may be folded flat for sh pment o storage It hangs on two L shaped hooks



Tiny Parts Cut from Paper

VERY small ship model fittings such as boom and gaff jaws and other t ny craft work parts usually made of wood can be cut from six or seven layers of bond paper glued together with cellulose cement

Ivy-Pot Bracket of Hammered Copper

ALTHOUGH there are many ways to hang a pot of ivy against the wall one of the simplest and most ornamental is to make a bracket like the one illustrated You may indeed wish to construct several of them because they are so simple They can be hung on windows or walls as preferred Adapt the dimensions to suit the pot used In this case it happened to be 3 in diameter at the bottom 4½ at the top and 4" high

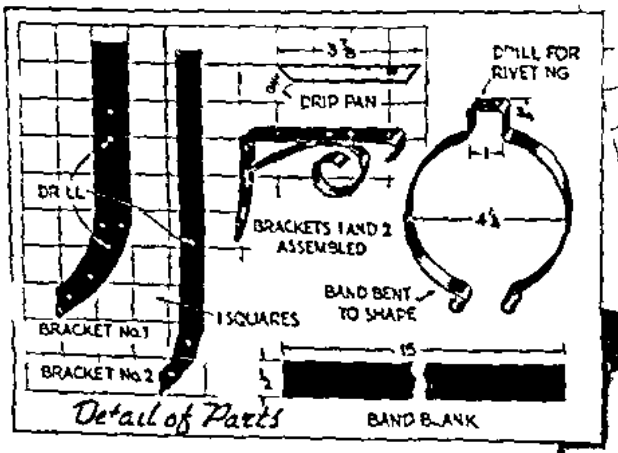
The back plate is outlined on a piece of 14 gauge soft sheet copper and is cut with the tin shears and a cold chisel filed smooth and hammered on the face The bracket parts and the band are cut from 16 gauge stock and are hammered and formed as shown in the drawings The drip pan is a disk of 18 gauge soft sheet copper It is raised to a depth of about ⅜ then the bottom corner is formed

Assemble all parts with No 14 brass rivets or escutcheon pins Swab the surface with a liquid solution of copper nitrate and heat until black Dust off and repeat until completely black then wax with floor wax and polish

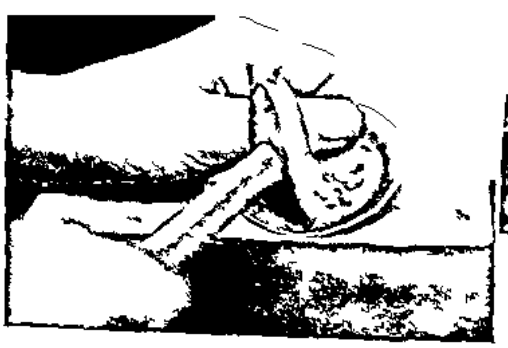
Iron may be used in place of copper and painted dull black —DICK HUTCHINSON

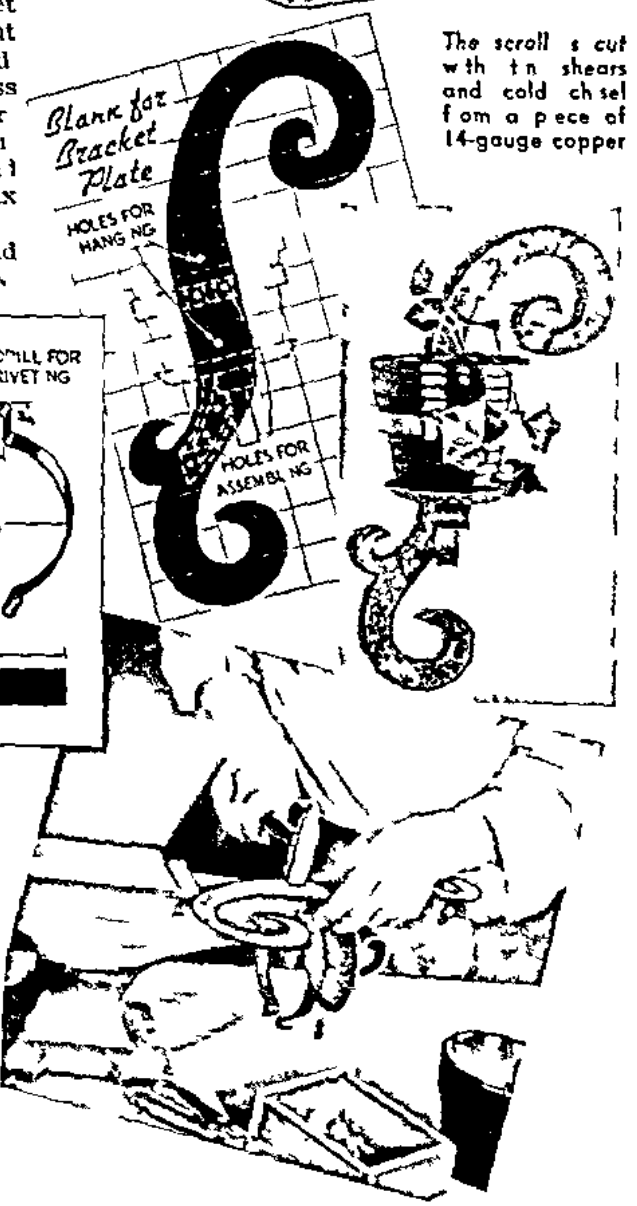


The scroll is cut with tin shears and cold chisel from a piece of 14-gauge copper



The parts are riveted together as at right Below forming bottom corner of the drip pan





Modern Toast Rack Made from Disks of Walnut

THIS decorative toast rack consists of seven disks of ⅝" walnut cut 5" in diameter and six maple separators cut from ¾" stock to the shape shown. The pieces are assembled with ¼" birch or maple dowels A walnut handle is scroll sawed as indicated and attached to the center walnut disk by means of two ¼" dowels but in this case they should be walnut The feet are turned from ¾ walnut and the tenons on them are glued into holes drilled in the first separator at either end Two coats of thin shellac are applied and the surface is rubbed down with steel wool between coats



BROWN AND GREEN COLORS [*METAL WORKING*]

The following formula will produce a permanent finish either brown or black on copper brass bronze or nickel silver

Place some commercial nitric acid in a glass jar and dissolve all of the scrap copper that the acid will consume thereby producing a liquid copper nitrate Do not allow this solution to come in contact with the hands or clothing Using a swab coat the surface of the piece to be colored with the acid Apply heat preferably with a blowtorch until it turns first green then brown Stop the heat the moment the piece is all brown or the color will burn out Let cool and dust off If the color is not dark enough repeat the operation

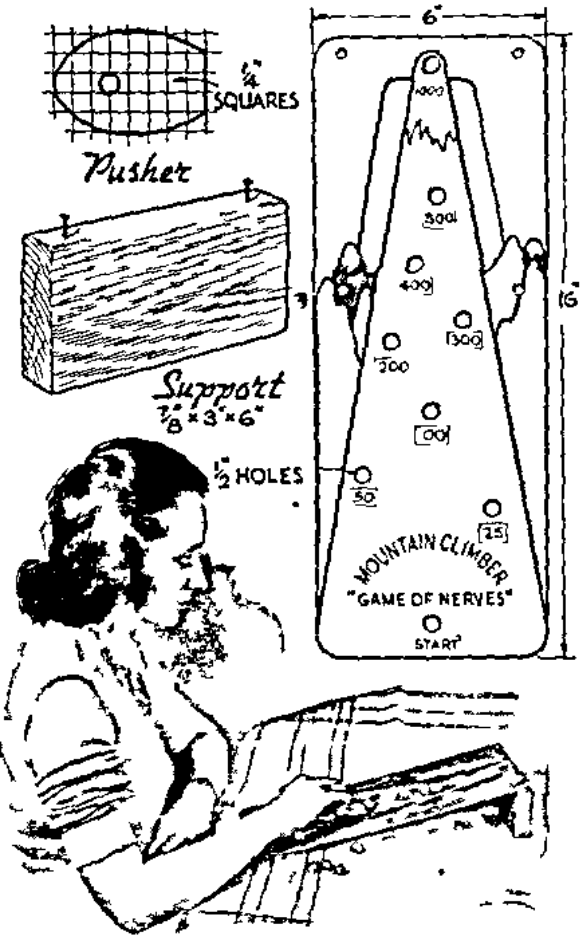
About three burnings will be required to produce a good black finish. If the brown finish is used burnish the high lights on the hammered parts with fine emery paper Polish the finished work with ordinary floor wax *No lacquer* is necessary

A satisfactory verd antique or verdigris green finish may be produced by coating the piece with copper nitrate as above and allowing it to dry in the sun or in a warm room When thoroughly dry coat with lacquer This is excellent for out-of-doors work such as lanterns hardware and copper trim

POPULAR SCIENCE MONTHLY SHOP DATA FILE

New Marble Game Tests Steadiness of Hand

'MOUNTAIN CLIMBER is a fascinating new table game in which marbles are pushed up an incline with the aid of a small flat stick until they fall into numbered holes Although the game may look easy the marbles have a tendency to roll off the side of the stick A good score therefore calls for steadiness of hand and calm nerves Considerable practice is required before one can control the marbles

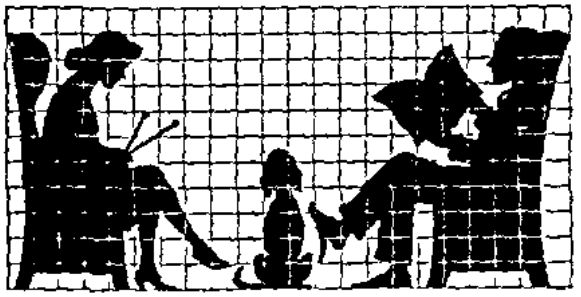


The object of the game is to push marbles up the mountain so that each stops in a numbered hole

Each player is given five marbles for the climb When all have been used the ones which have been successfully deposited in holes are counted according to the value of the holes The highest score wins

Once a marble drops into a hole it cannot climb again When a marble falls down the mountain it is lost

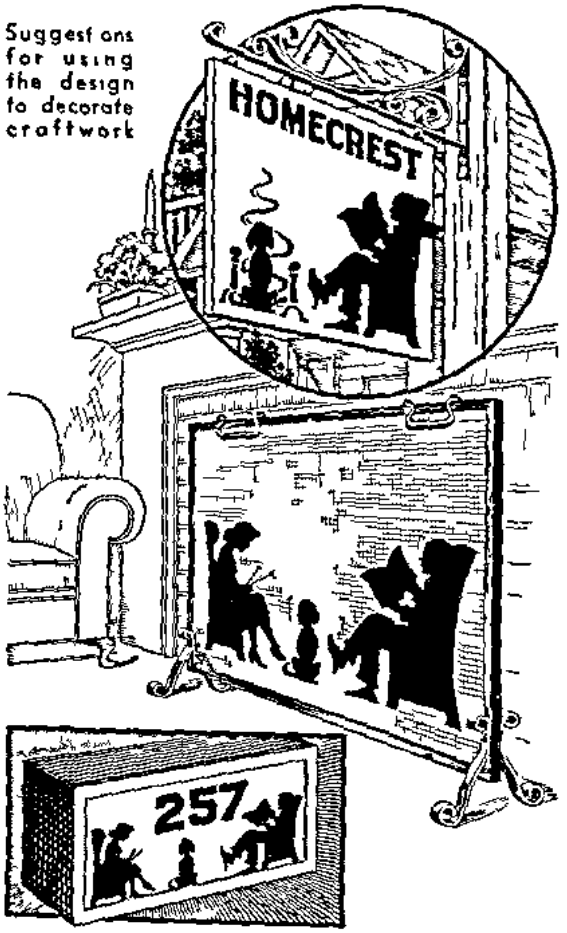
Whether made of heavy cardboard or wood the incline should have a smooth flat surface Paint or wax crayons may be used for the decorations.—MYRON FLEISHMAN



Silhouette of the Month: "Fireside Comfort"

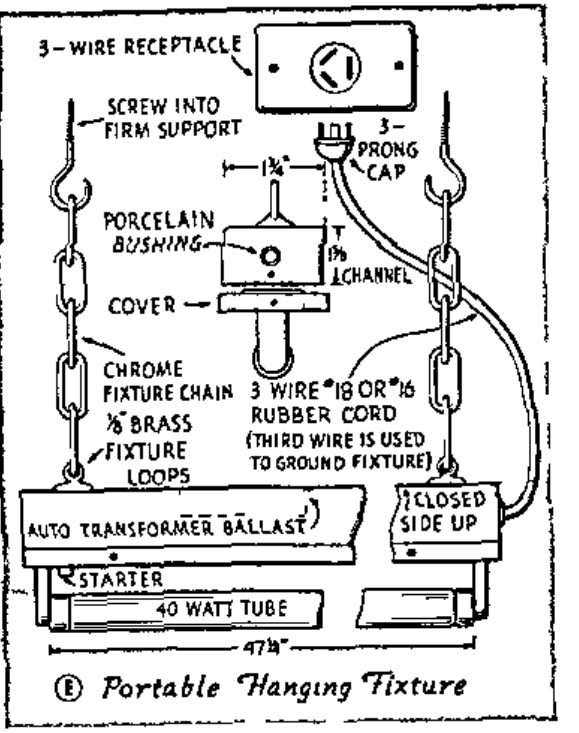
HERE is a silhouette that can be adapted to many purposes Scroll sawed from ply wood the figures can be used for example as a name board or to ornament an illuminated house number Cut from sheet metal they will decorate a fireplace screen Since they are separate the figures can be set as far apart as the individual project requires or they can be used individually Any degree of enlargement may be obtained by drawing squares of the necessary size and copying the outlines through the squares from point to point

Suggestions for using the design to decorate craftwork

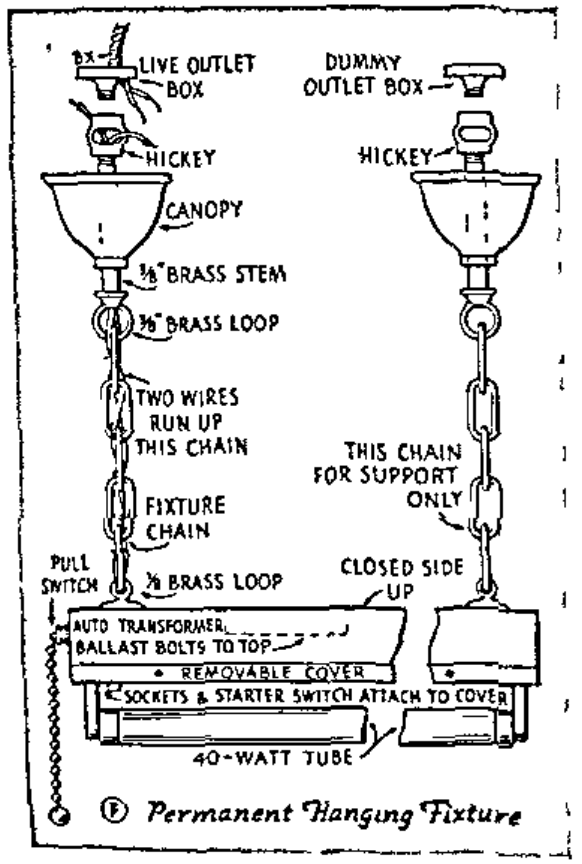


BUILDING YOUR OWN Fluorescent





Ⓔ *Portable Hanging Fixture*



Ⓕ *Permanent Hanging Fixture*

A THIRD problem in building fluorescent lighting fixtures is where a portable fixture is desired, and the ceiling height is such that the lamp must be suspended on chains The fixture is made as before (drawing *D*), but it is suspended by means of two brass loops and chains, as at *E* A rubber cord and plug allow connections to be made to a three-wire polarized receptacle

Reflectors can be easily added to any of these fixtures by bending up the material to the required shape, as shown in drawing *G* Polished aluminum or sheet metal sprayed with white enamel or lacquer gives a satisfactory surface

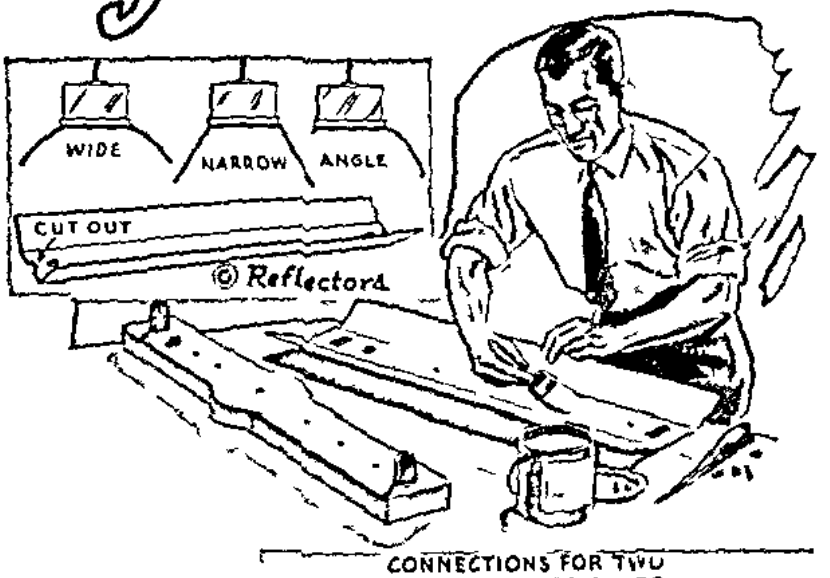
In general, 15 watt 20 watt, and 40 watt tubes are 1½" in diameter and have a comparatively low surface brightness Because of this they can be used exposed without reflectors and will give a good spread of light all over a room On the other hand, the 1" diameter 15- and 30 watt tubes are somewhat brighter and should be used in a reflector when possible to protect the eyes

One of the main features of the fixtures illustrated is the use of the new separate starter switch Formerly the switch and reactor were combined in one unit called an auxiliary If the switch went bad the whole

Lighting Fixtures

PART TWO

By HAROLD P. STRAND



unit had to be replaced The latest advance in the industry is a small starter switch which is easily inserted and removed from the bottom of the fixture With this is used a simple ballast or reactor

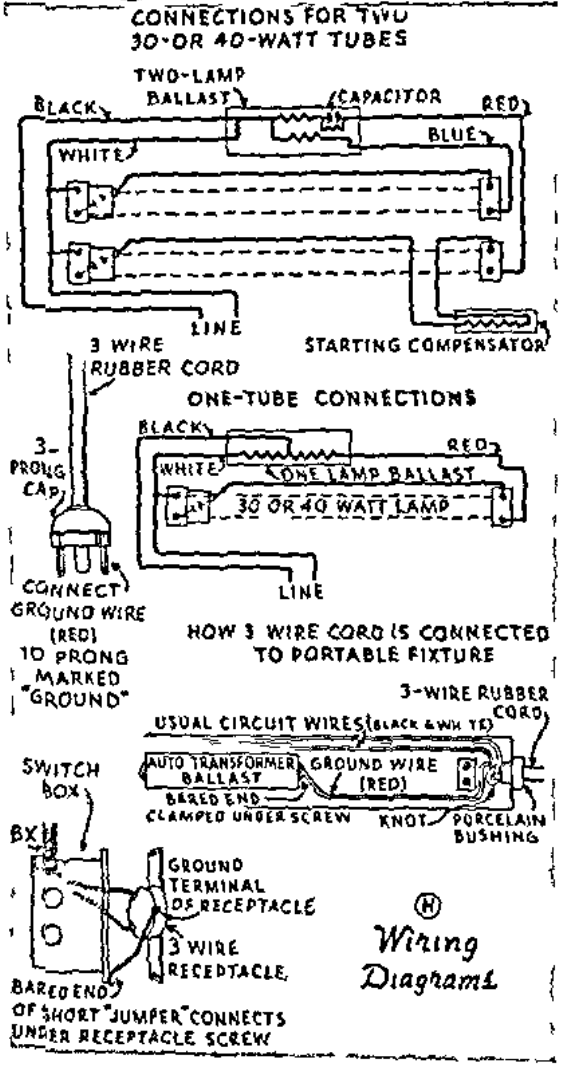
If, however, 30- or 40-watt tubes are to be operated an auto-transformer must be used with the starter switch and it also serves as the ballast. This is because the longer tubes do not operate directly at the low 115 volt pressure, but must have equipment to step it up to the required voltage

An excellent method of hanging fixtures permanently on chains is shown at *F*

When making fixtures using two tubes a two lamp ballast unit can be substituted for two ballasts This contains a capacitor to correct low power factor and flicker, and makes an efficient control unit However, care must be taken to see that the channel dimensions are sufficient to accommodate the larger unit When using this type of unit and separate starter switches with the 30- and 40-watt tubes, however, a separate compensator may have to be used in addition This is placed in the channel with the ballast (drawing *H*)

With single-tube fixtures the low power factor that is characteristic of fluorescent lamps can be corrected by installing small capacitors in the channel If preferred, however, a larger one can be installed elsewhere to take care of several lamps For an individual lamp, a capacitor of 4 75 microfarads will bring up a power factor of about 50 percent to nearly 90 percent A capacitor of 17 5 microfarads can be used for five 30- or 40-watt tubes with a thermal type auxiliary or starter to obtain 90 percent power factor These devices are connected across the line at or near the ballast

Fluorescent lamps can also be operated





Fluorescent fixtures are ideal for the laundry room

on direct current with some success In general only the 15 and 20 watt sizes can be used because it is not possible to step up 115 volt current to the higher voltage for starting the larger lamps

The only change necessary for DC operation is to connect a resistor in series with the reactor or ballast to limit the current Care must be used to ventilate the resistor properly because of heating and connections should be made with wire having heat resisting insulation At 120 volts the 15 watt T 8 tube requires a resistor of 198 ohms and the 20 watt T 12 tube a resistor of 144 ohms For 115 volts resistors of 180 ohms and 125 ohms respectively would be required The efficiency is less than with A C operation

The construction described is standard practice but some localities may have adopted special regulations so ask your electrical inspector if in doubt

Foil-Lined Lamp Shade Acts as a Reflector

BY LINING them with metal foil metal lamp shades like the conical one shown can be made into efficient reflectors that concentrate the light mainly in one direction The foil can be fastened by coating the shade surface with spar varnish enamel or baking enamel letting it dry until tacky and then pressing the lining into contact It can be smoothed out to make a good specular (mirrorlike) reflector or crinkled to scatter the reflected light over a wider angle



FLEXIBLE CORDS TO USE [ELECTRICAL]

When an electrical appliance requires the replacement of its cord select the proper type of cord to insure safe operation as follows

Use	Trade name	Type	Outer covering
Flat irons toasters waffle irons grills room heaters mangles used in dry places	Heater cord	HPD	Cotton or rayon
Heating use damp places	Rubber jacketed heater cord	HSJ	Cotton and rubber
Lamps small radios light appliances dry places	Parallel cord	PO 64 PO 32 PO	Cotton or rayon
Lamps etc damp or dry places	All rubber Parallel cord	POSJ 64 POSJ 32	Rubber
Vacuum cleaners large radios dri s refrigerators washing machines shop motors etc damp or dry places	Junior rubber cord	SJ	Rubber
Extra hard usage or heavy duty	Hard service rubber cord	S	Rubber
Subject to mechanical injury dry places	Armored reën forced cord	PA	Cotton and metal armor

POPULAR SCIENCE MONTHLY SHOP DATA FILE

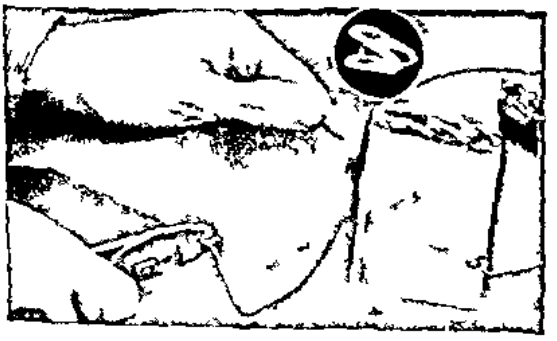


BX-Conduit Saves Time in Coiling Fish Tape

ONE electrician coils his fish tape through an 18 piece of BX so it can be handled rapidly without kinking By holding the flexible BX in one hand and revolving the rolled steel fish tape with the other hand he feeds the tape into the conduit swiftly

Attaching Wires Quickly

IN EXPERIMENTAL work wires can be connected temporarily to sheet metal or screen wire with brass paper fasteners of the type shown Insert the wire into the fold of the fastener and squeeze shut over the edge of the material For sheet metal punch a small hole Solder for greater permanency



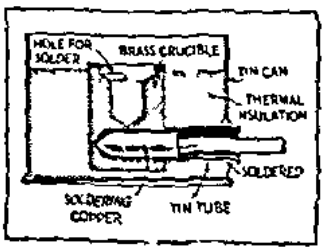
Soldering Copper Heats Miniature Furnace

RADIO repairmen electricians and others having occasion to tin wires or similar small parts will find the miniature electric furnace illustrated below a great convenience

The brass crucible is a short piece of brass rod of a diameter slightly greater than the length of the small soldering copper head A hole is drilled to receive the copper and another to form a cavity for the molten solder The crucible is placed in a housing made by cutting down a tin can and surrounded with thermal insulation such as glass wool asbestos or plaster A tube made from a piece of the tin can connects the lateral hole in the crucible with the outside of the housing If the insulating material does not hold the parts securely fasten the crucible with a machine screw through the bottom of the housing

The soldering copper may require ten or fifteen minutes to heat the crucible to the melting point of solder The process can be hastened if necessary by directing a torch flame into the furnace from the top A lid made of asbestos or other suitable material will reduce the escape of heat from the top To tin wire ends coat them with flux and dip them into the molten solder The soldering copper can be removed for several minutes at a time without permitting the solder to solidify It is best to place a thin layer of insulation under the furnace so the bench top will not be scorched if the metal becomes too hot.—ERVIN WALTERS





In the furnace shown above the thermal insulator was sand which was covered with wood fiber plaster after the device had been tested

Stopping Action

By R. O. LISSAMAN



Foot race at angle to camera First man s Ta sta Mak coached by Paavo Nurm

WHEN you photograph a moving person animal or object the image moves across the surface of the film—that is the focal plane of the camera—for the duration of the ex posure For the action to appear completely stopped the exposure must be brief enough to permit a movement of not more than about 0 01 when the finished print is viewed at normal viewing distance Although an image displacement of 0 01 will be satisfactory for a contact print a negative that is to be enlarged must show less movement than that For ex ample if it be desired to enlarge the negative five times the film should have an image displace ment of not more than 0 002 An accompanying table gives the approximate exposure for stopp ng action of various types The shutter speeds are



Act on d rectly across the camera as n th s case requ res faster exposure than movement at an angle

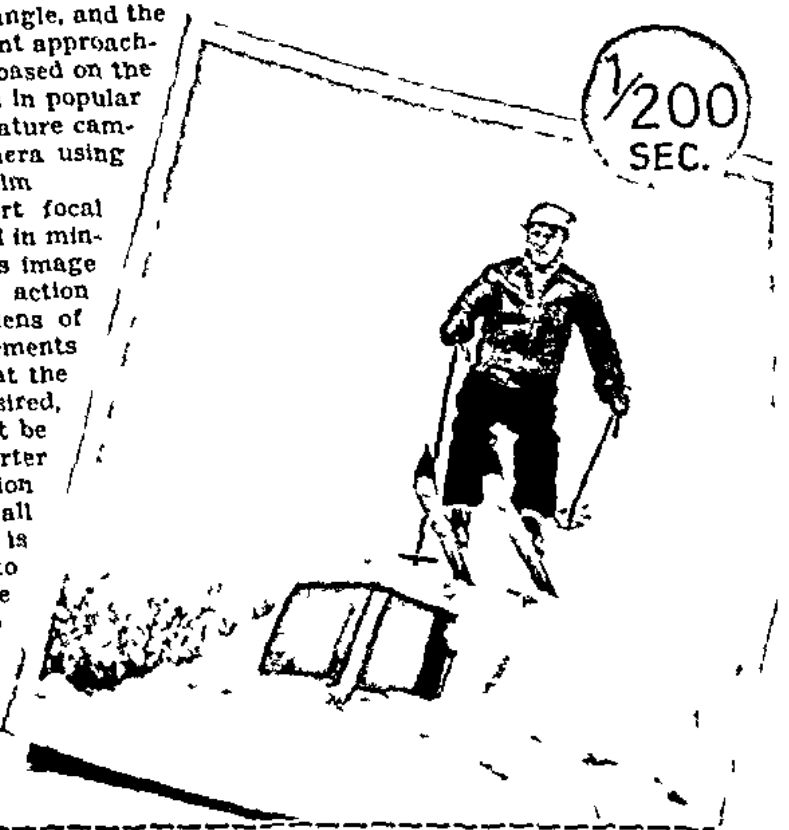
with Your Camera

the slowest that can safely be used In each case for action of 20 m p h. or faster, three speeds are indicated The fastest is for use when the movement is across the field of vision from right to left or vice versa The second is for movement at an angle, and the third or slowest is for movement approaching the camera The table is based on the average focal length of lenses in popular use, that is, a 2" lens for miniature cameras and a 4" lens for a camera using the so-called twenty size film

For contact prints, a short focal length lens, such as those used in miniature cameras, will show less image displacement with the same action and same exposure than a lens of longer focal length If enlargements are to be made, remember that the greater the enlargement desired, the shorter the exposure must be Close-up action requires shorter exposure than does distant action

Although the table gives all the information an amateur is likely to require in learning to make good action shots, there are some photographers who are keenly interested in theory For their benefit the following formula is given for working out the exposure necessary to stop action in any individual case *All measurements must be given in inches*

1 Distance object will move compared



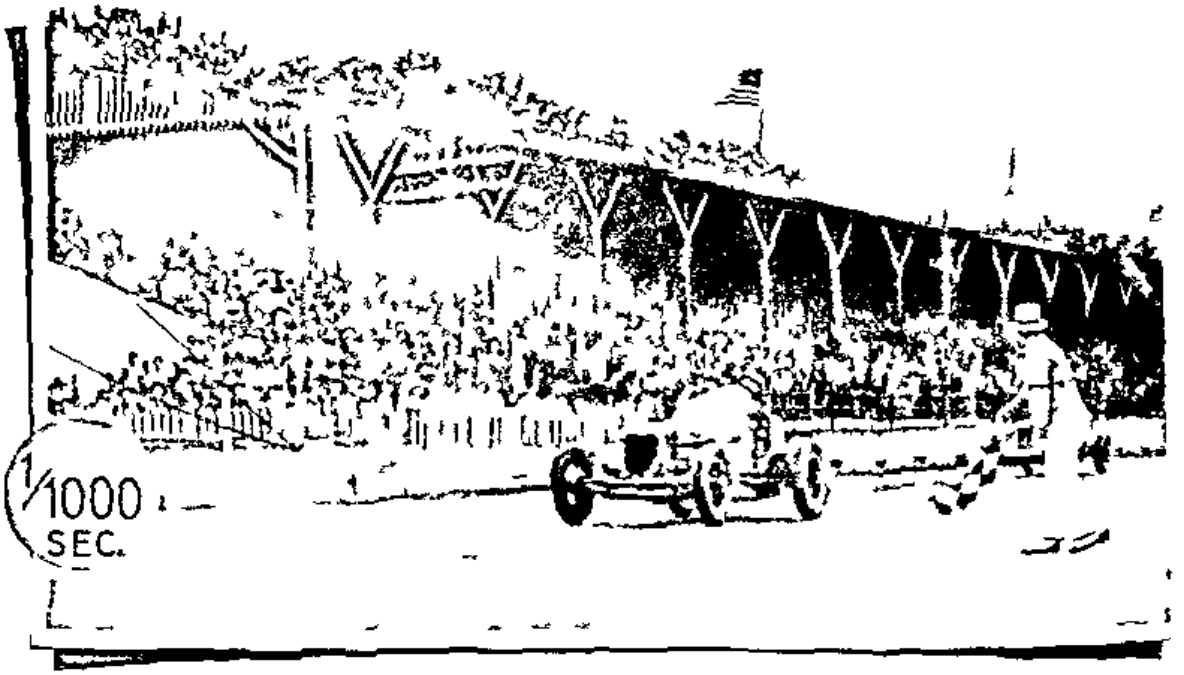
Approaching action at a speed of about 35 m p h An exposure of 1/200th second stopped it

EXPOSURES TO STOP ACTION [PHOTOGRAPHY]

Exposure for average miniature camera			Action	Miles per hour	Exposure for average 2¼" by 3¼" camera		
1/15 to 1/50			Average views pe destrians etc	5	1/25 to 1/100		
↔	⤫	↓			↔	⤫	↓
1/100	1/65	1/40	Athletic events foot races boats baseball slow street traffic etc	20	1/200	1/130	1/80
1/200	1/130	1/60	Brisk traffic horse races motor boats diving etc	30	1/400	1/260	1/120
1/350	1/250	1/125	Highway traffic birds on wing planes fast trains etc	60	1/700	1/500	1/250

Note Use the shutter speed closest to the given speeds For general use speeds slower than 1/50 should not be hand held especially if enlargements are required The above figures will permit only contact prints or small enlargements to be made The greater the enlargement desired the shorter the exposure must be

POPULAR SCIENCE MONTHLY SHOP DATA FILE



Snapping the finish of an auto race takes real speed especially if you intend to enlarge the negative

with permissible image movement which can be stated Displacement permissible $\times \frac{\text{Distance to object}}{\text{Lens focal length}}$ or $Disp \times \frac{D}{F}$

2 Distance object will move in 1 second At 1 mile per hour 5 280 or 63 360 object will move $\frac{63\,360}{60}$ or 1 056 in 1 minute and $\frac{1\,056}{60}$ or 17 6 in 1 second

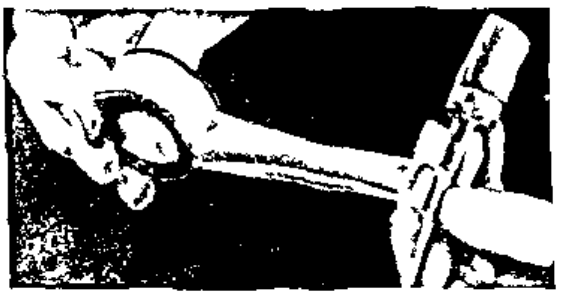
Thus the formula may be stated Required exposure in seconds=

$$Disp \times \frac{D}{F} - (17\,6 \times m\,p\,h)$$

Example To photograph a train at 60 m p h. at 50 (600") distant with lens of 3" focal length

$$\frac{1}{100} \times \frac{600}{3} - \frac{17\,6 \times 60}{1} = \frac{1}{100} \times \frac{600}{3} \times \frac{1}{17\,6 \times 60} = \frac{1}{528} \text{ second}$$

This gives the exposure when the movement is passing directly across the camera field of view Action approaching or leaving the camera at 45 deg may be stopped with one third longer exposure Action directly approaching or leaving may be stopped with *two thirds longer exposure*



Scoop for Small Bottles

A SCOOP for getting into small necked bottles when weighing photo chemicals may be made from a face powder scoop of the type shown above These scoops are designed for filling compacts and usually sell for five cents All that is necessary is to extend the handle with a section of discarded knitting needle or a small dowel

Roll-Film Tank Corked to Keep Out Dust



AFTER using a roll film developing tank it is advisable to plug the opening in the lid with a small cork or a pledget of cotton to keep out dust and chemicals that may be floating in the air —E A B

• • •

WHEN I have to make several prints of a photograph I borrow the metronome from its place beside the piano By counting its ticks I can time the exposures and also the developing period —FERDINAND G HUF



Wet Prints Trimmed Easily with Knife

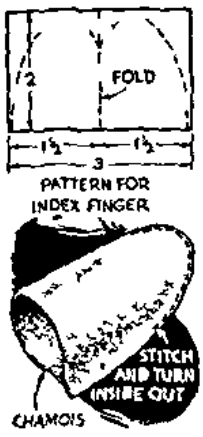
IF NO trimming board is available by far the easiest way to trim photo prints surprising as it may seem is immediately after they have been washed and while they are still wet

Place a wet print face up on a smooth board, such as a bread board a piece of plywood or a drawing board, and cut it with a very sharp, large pocketknife blade a hunting knife, or any other stiff-bladed knife A large drawing triangle makes the best guide because it gives greater safety to the fingers and can be held down better than a ruler —O P SHIER

Avoiding Finger Marks When Loading Film

FINGER marks on film can cause irreparable damage, especially in warm weather or in a hot, poorly ventilated darkroom, when one s fingers are likely to be quite moist Such blemishes are easily avoided, however, by using a pair of soft chamois finger cots for the thumb and forefinger These will absorb moisture and protect the film while a tank or film cartridge is being loaded

Cut a rectangle of paper 2" by 3' for the forefinger and another $1\frac{1}{2}$" by 4 for the thumb Wrap them around the fingers, mark the approximate size and shape, and use them as patterns for cutting the chamois Stitch the cots as shown fitting them so tight they won t slip off Make a new pair when they begin to get dirty or collect too much lint —NATHAN SPERBER





RETOUCHING PRINTS, PART I [PHOTOGRAPHY]

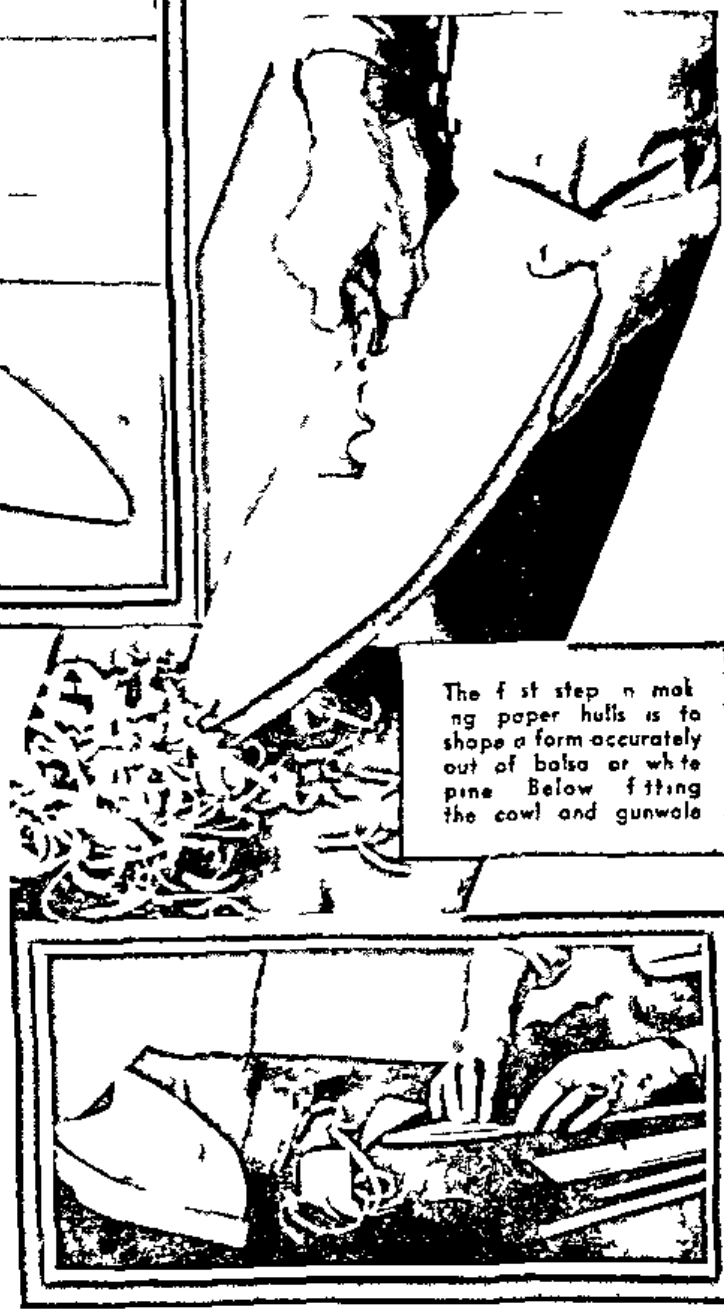
With Artist's Black Oil Color. First apply a sizing medium to entire surface of print with a wad of cotton (A good sizing medium consists of 1 oz. turpentine, ⅛ oz. linseed oil, and from 15 to 20 drops of japan gold size. Shake together well and let stand overnight.) For shading large areas, charge a cotton wad with black oil paint, and rub it on waste paper until the color can be applied lightly and evenly. For smaller areas use bits of cotton twisted on the end of a toothpick or a paper stump For lines and spots, use a spotting brush and thin the color with turpentine Remove undesired or surplus color with the sizing medium. A scrap of glass will serve as a palette

With Printer's Ink Obtain half-tone black from a local printer or printing supply house No sizing medium is required Use like oil color, but thin with artist's pale drying oil A soft eraser will remove undesired ink while still wet This is a versatile medium and leaves such a tough film that glossy prints retouched with it may be referrotyped

POPULAR SCIENCE MONTHLY SHOP DATA FILE

PAPER





When the paper hull has dr ed it is sanded and pa nted then sl pped off the form The 18 hull shown we ghs sl ghtly over four ounces

The f st step n mak ng paper hulls is to shape a form accurately out of balsa or wh te pine Below f tting the cowl and gunwale

By
J. W. CLEMENT

EXCEPTIONALLY light strong hulls for model speed boats can be made up of layers of gummed paper laid over a form cut from a solid piece of balsa or white pine The form Fig 1 should be accu rately shaped but need not have a perfect surface

If your model is to have a deck it should be fitted to the form and held in place with two small brads or weak glue so that it can be removed aft er the hull is dry When a steam power plant is to be installed, a deck will only be in the way and it will be more practical to reenforce the hull, after the form is re moved, with strips of white pine or mahog any as shown in Fig 2 The transom may also be made of wood fitted to the form and glued in place the same as the deck

As you may wish to use the form again it is a good plan to give it a coat of linseed oil or hot paraffin It is then covered with strips of wet newspaper laid approximately three layers deep No glue is used.

The gummed paper which goes on next, should not be over 1" wide Cut off pieces a little longer than the form and, after dip

HULLS FOR MODEL SPEED BOATS

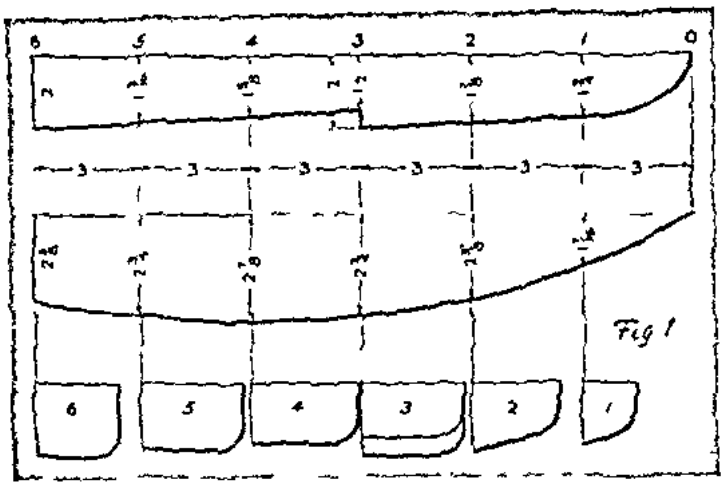


Fig 1

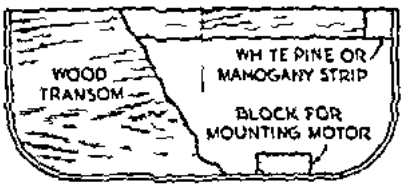


Fig 2

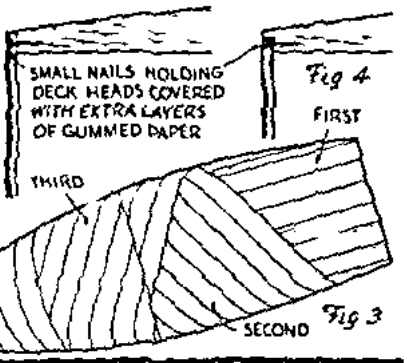
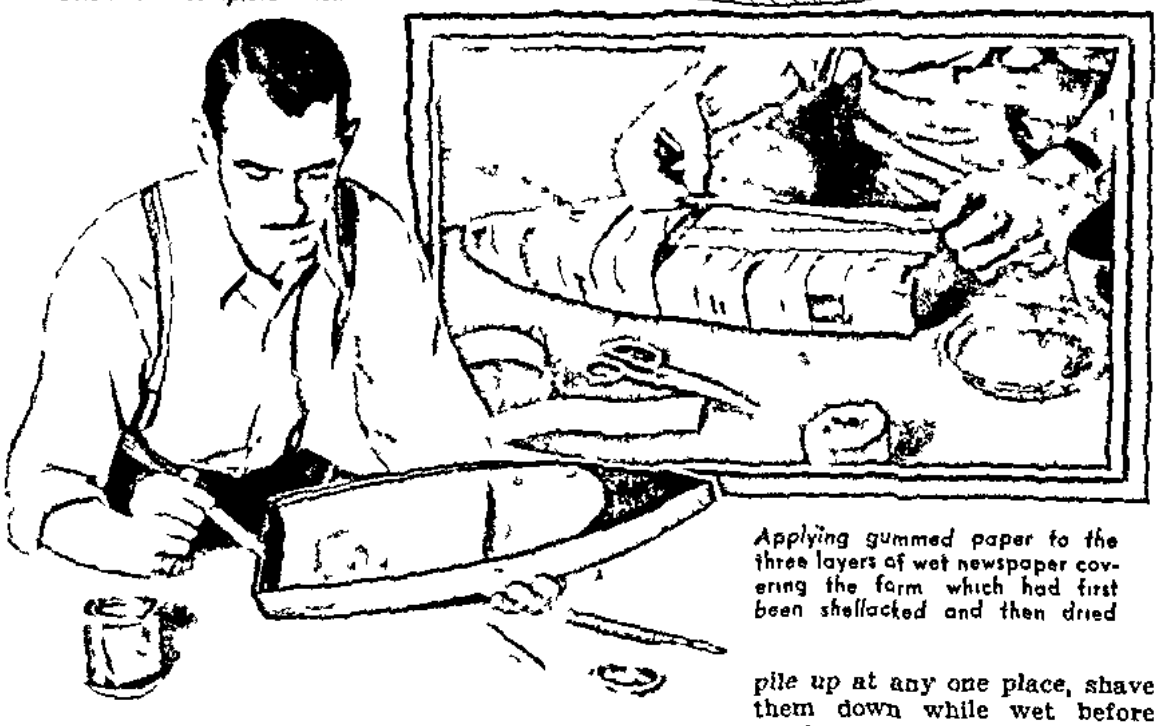


Fig 4

Fig 3

Shape of the form and how the hull is reenforced
Below the completed hull will take a fine finish



Applying gummed paper to the three layers of wet newspaper covering the form which had first been shellacked and then dried

ping them in water, lay them lengthwise from stem to transom, parallel to the keel The strips should lap about one quarter of their width The second layer of paper is put on diagonally over the form, and the third layer at right angles to the first diagonal layer

Wherever the strips have a tendency to pile up at any one place, shave them down while wet before putting on the next layer Also add small pieces where needed so that approximately the same number of layers make up the entire hull If the hull is 18" long—a good size for your first model—five or six thicknesses of the gummed paper should be sufficient to withstand all ordinary usage

When the hull is completely dry, it should be smoothed up with sandpaper and given

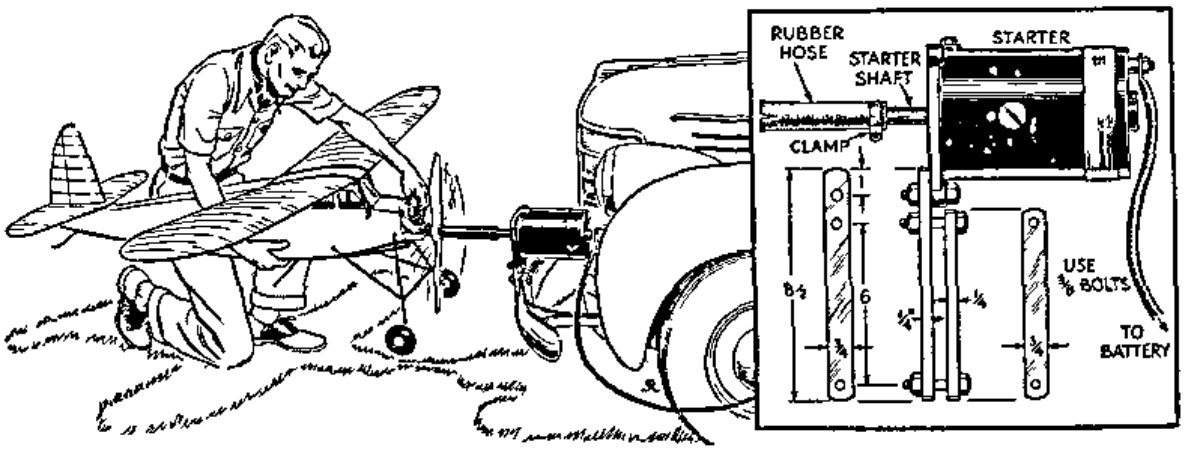
two or three coats of paint Sand each down

Next remove the paper hull from the form Strips of wood are glued to the hull along the edge blocks are fastened to the bottom to hold the motor and another block is placed at the step to take care of the propeller shaft tunnel If you have used a wooden transom brads should be driven in around the edge to hold it in place Stick additional strips of paper over the heads of the brads to cover them and repaint

The inside of the hull should be finished with two coats of varnish Be careful that all corners are covered because any place left exposed will absorb moisture and ruin the hull

With this method several duplicate hulls can quickly be made for competitive racing

Electric Starter Spins Model Airplane Props



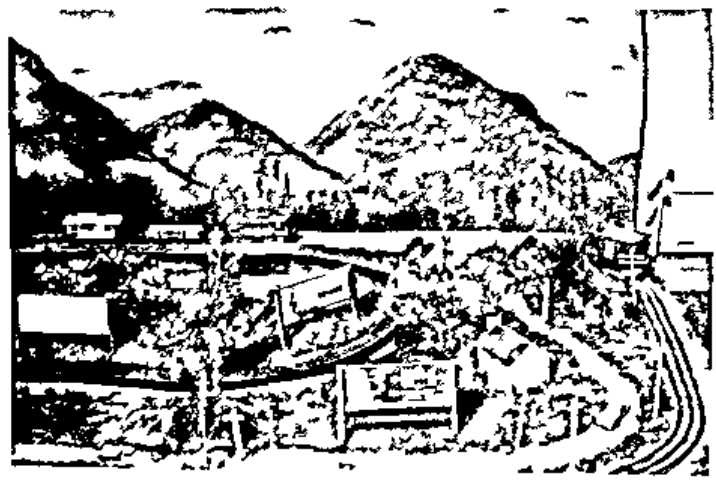
THIS electric starter for model airplane gas engines will overcome the starting troubles usually encountered at model air plane meets

An old 6 volt auto starter motor is ob tained and reconditioned A piece of garden hose 6" long is securely fastened to the starter shaft with a hose clamp then split back about 1" at the other end so it will flare out and fit over the nut on the propeller shaft. The starter is clamped securely as shown to the bumper of an automobile to which it is grounded and the cable which should be heavy enough to carry about fifty amperes is clipped to the car battery

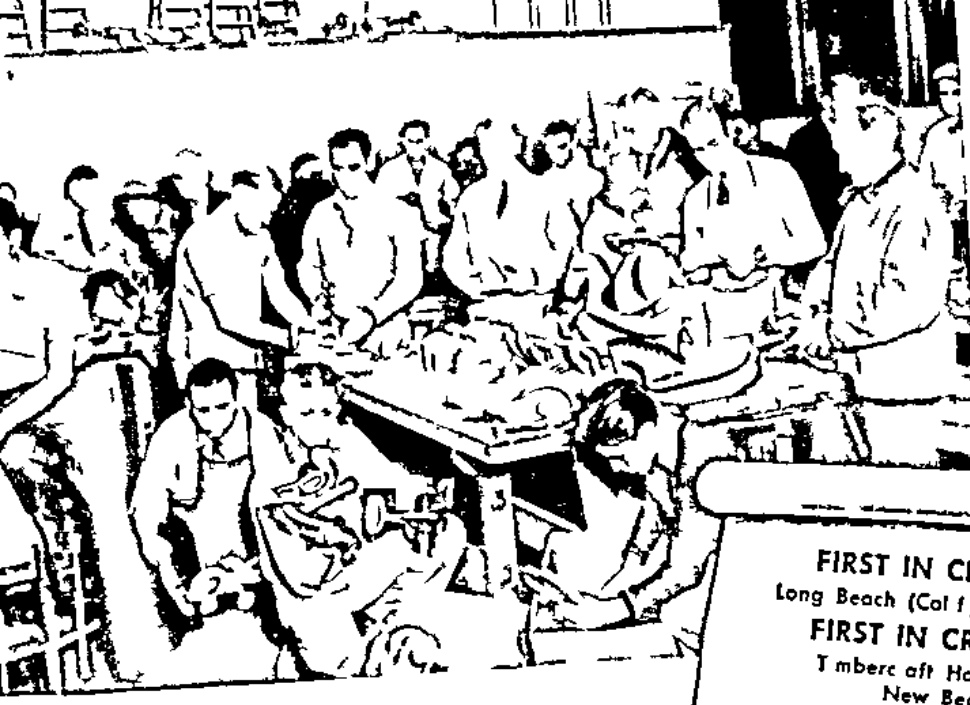
The flyer holds his model plane in position with one hand so the propeller hub presses against the hose on the shaft of the starter and then uses the other hand to adjust the gas needle A plane motor usually starts in a few seconds —ARTHUR C STROHM

Painted Scene Sets Off Miniature Railway Layout

ANY ordinary model train dis play can be made more at tractive and realistic by a painted background showing scenery The background illus trated was painted by a pro fess onal sign painter on a piece of oilcloth 3 high and 8 long (the length of the layout) Brown dark green and tan show card colors were used in depicting the mountains and blue in several shades and white completed the sky While the paint on the mountains was still wet artificial snow was sprinkled on to give a snow capped effect Large travel posters often pro vide suitable scenes —C E. B



D sploys become much more real st c when backgrounds are added



More than 5 000 toys were made by the Long Beach club At extreme r ght is Edward Abe al 84 who pa nted 1 000 of the toys by hand

FIRST IN CIVIC ACTIVITIES
Long Beach (Cal f) Homecraftsmen s Club
FIRST IN CRAFTSMANSHIP
T mberc aft Homeworkshop Club
New Bedford Mass
FIRST IN CLUB PROGRAMS
Portland (Ore) Homeworkshop Club
HONORABLE MENTION
CIVIC ACTIVITIES—Ashtabula (Oh o) Homecraft Club Columbus (Oh o) Homecraft Club Sag naw (M ch) Homecraft Club
CRAFTSMANSHIP—B son Homeworkshop Gu ld Buffalo N Y

THREE Guild Clubs WIN NATIONAL AWARDS

IN RECOGNITION of their excellent work POPULAR SCIENCE MONTHLY is awarding large silver plaques to the three home workshop clubs that led the National Homeworkshop Guild during the past season in the fields of civic activities craftsmanship and programs for club meetings

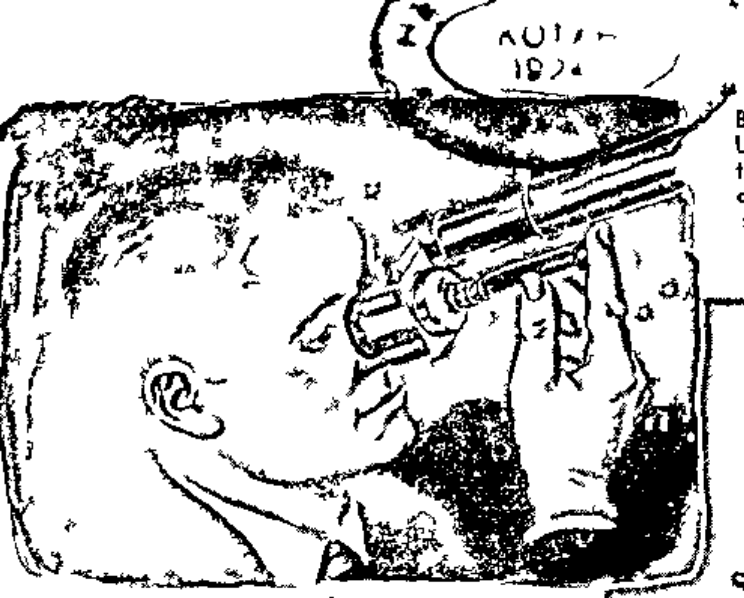
The award for civic activities goes to the Long Beach (Calif) Homecraftsmen s Club Its 110 members constructed 5 010 toys for distribution to poor children through the Christmas fund of a local newspaper and 359 additional toys for the Salvation Army a Mexican mission and special cases The club also made shipping boxes for bandages and clothing sent to Finland and Poland first aid splint sets for the American Red Cross game boards for the social room of a church and envelope containers for 100 pews in another church

The Timbercraft Homeworkshop Club New Bedford Mass wins the craftsmanship plaque through the efforts of Charles Jeglinski its secretary who designed and built the nautical chest described elsewhere in this issue Mr Jeglinski will receive a special craftwork medal for his work

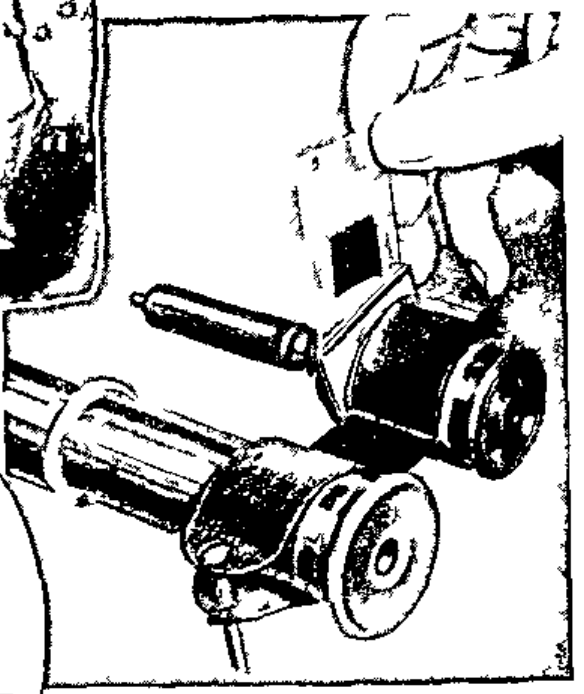
In the program division of the contest the Portland (Ore) Homeworkshop Club carries off first honors That club was the subject of a recent feature article (P S M June 40 p 164) By means of its high standard of programs and an extensive publicity campaign it has built up a large and active membership

The Sag naw Homecraft Club presented its entry n the form of a beaut ful al bum hav ng veneer pages on wh ch were photos and a descr pt on of the project



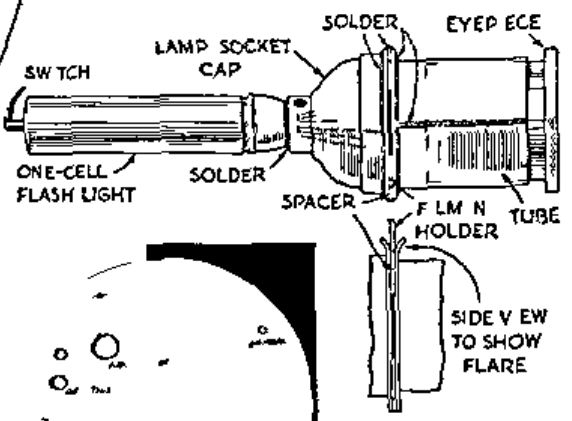


Below nse t ng a f lm n the v ewer Left by turn ng on the flash l ght the mage s compa ed w th the actual ob ect The des gner of the dev ce s a d st ngu shed amateur ast onomer



SIMPLE Film Viewer Identifies Celestial Objects

By L. C. PELTIER



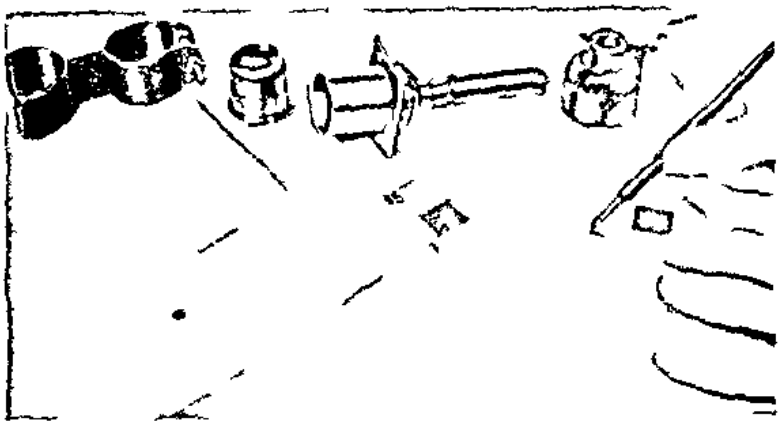


Left ob ect and chart should ap- pear a'ke in s ze

ASTRONOMERS both pro fessional and amateur find it very difficult to point out to others some particular object in the heav ens especially through the tele scope The simple little device shown however will unerringly point out a special star in a field full of stars of similar ap pearance

It consists of a metal film holder to one side of which is soldered a tube for holding a magnifier or eyepiece and to the opposite side is soldered a small flash light A flash light clamp such as is used on automobile steering posts holds the device on the tele scope tube so that the observer can see through both telescope and viewer at the same time A greatly reduced photograph is made of a chart or sketch of each region or object to be identified This negative is placed in the holder and the object seen in the telescope is compared directly with its corresponding film image seen by trans mitted light from the flash light

Owing to the great reduction it is usually possible to make two or three transparencies



In making the photograph a copy practically any type of camera and film can be used Each chart is numbered for easy identification

on one negative and then divide and trim them to size after development. It is of course best to make the copies to a scale which will correspond approximately with the telescopic view For example if the telescope shows the entire moon in one field of view the transparency when viewed through the magnifier should show a moon of similar size Standard astronomical charts can be photographed or you can draw your own

Neon Lamp Tests Circuits in Home Laboratory

AN ORDINARY neon glow lamp is a very versatile test lamp for the home laboratory or shop Used as shown it will indicate which terminals are live approximately what voltage is present its frequency and if D C its polarity

The bulb is a 2 watt 115 volt neon lamp costing 45 cents It has been screwed into a 10 cent pigtail socket after the ends of the wires were stripped and tinned In constant use for over three years on all voltages and frequencies it has saved many hours of guessing circuit tracing and unnecessary shock.

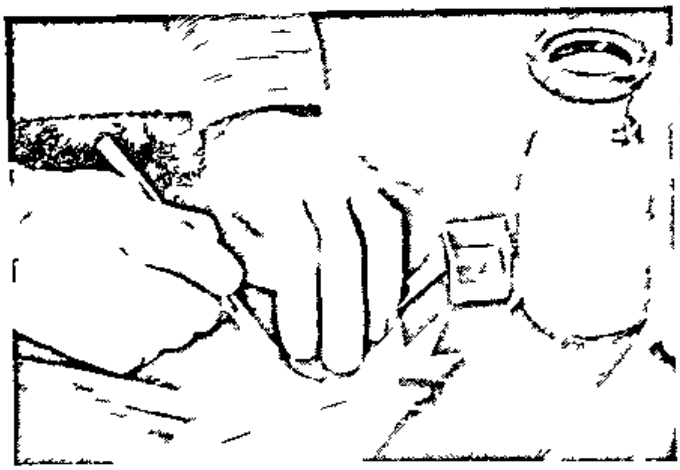
Unlike an incandescent lamp the neon bulb may be used on voltages ranging from 70 to 550 volts without damaging the bulb and it will light through resistances as high as 750 000 ohms for continuity testing The approximate voltage present may be determinated by the intensity and color of the neon glow once you have noted the appearance of the glow under specific conditions The frequency is shown by the way the plates light up Sixty cycle current shows as a steady glow on both plates 25 cycle current has a very noticeable flicker and on D C only the plate connected to the positive side of the line tested will become illuminated —R B STETSON

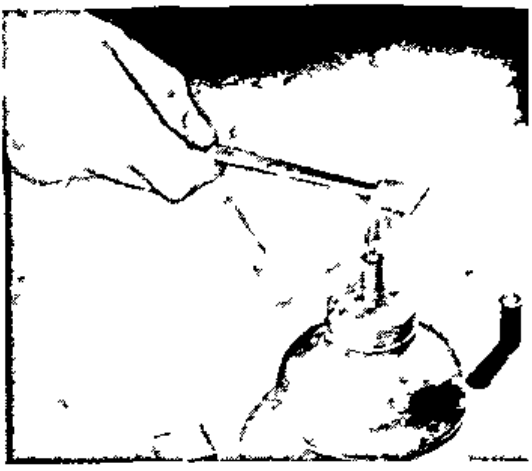




No Fooling—Oily Rags Are Really Dangerous

EVERY home worker has been told many times not to leave oil or paint soaked rags around his shop or laboratory but it is difficult to understand how great the danger is until a fire actually starts and then it may be too late The accompanying photograph taken by a contributor to this department shows the burnt remains of an apron used by a high school student He had been finishing a project on the lathe by rubbing it with linseed oil and unthinkingly rolled up the oil soaked rag in his apron and placed them in his desk drawer The building custodian found the smoldering apron four hours later and extinguished the fire





HOW TO PREPARE BACTERIA SLIDES 1 Spread bacteria laden material (here sour milk) on clean glass with the aid of a platinum loop

2 Kill and fix bacteria by holding the glass for a second at a time three times in an alcohol or gas flame

STUDYING BACTERIA



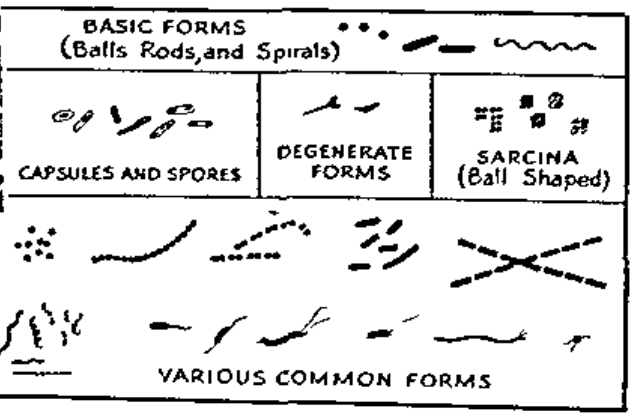
Principal types of bacteria you will see under your microscope are shown in the diagram at right The sooner you memorize them the more fun you'll have

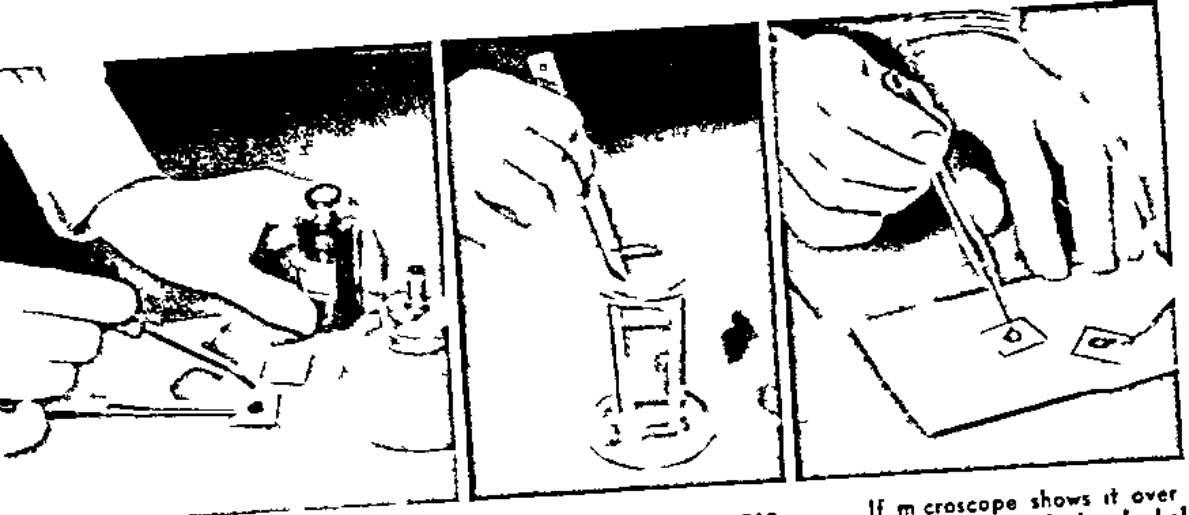
By MORTON C. WALLING

BACTERIA, the tiny plants that are the smallest and yet one of the most important of all living organisms, provide a fascinating and adventurous subject for the amateur microscopist. Of the many different types, some are vital to our existence, while others are destroyers of human and other animal life But all are interesting for microscopic study.

Where can you find a supply of bacteria for examination? The closest source is your own mouth, for if you touch your tongue to a microscope slide, or scrape your teeth with a toothpick, you'll have a ready supply of microorganisms for examination under your lens Bacteria may also be obtained from raw milk, buttermilk, finger-nail dirt, decayed matter, chicken livers, and a hundred other sources

The organisms are so tiny, however, that





3 D ssolve fat away w th xylol then drop dye solut on on the spec men Heat ng speeds up dye ng

4 After sta ning r nse the glass in water to remove the excess dye

5 If m croscope shows it over sta ned add a l ttle alcohol and qu ckly r nse w th water

with Your MICROSCOPE

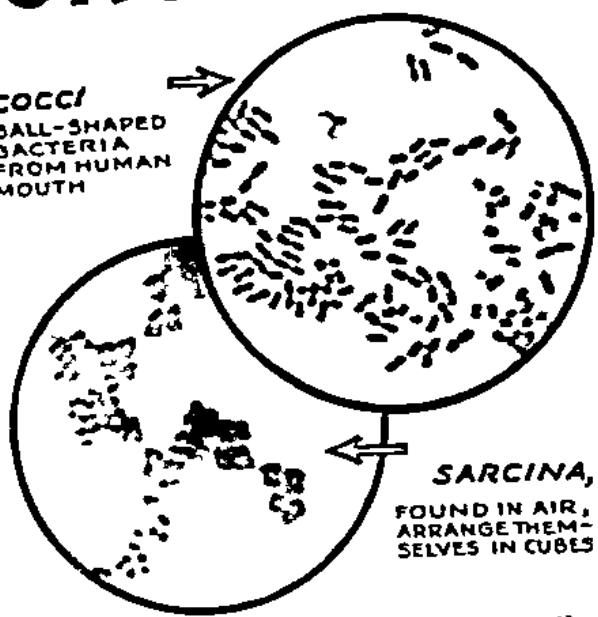
they must be specially treated to make them more visible under your lens This is accomplished by the process of staining The first step however is to kill and fix the organisms

One of the simplest and most widely used methods of fixing is to spread the bacteria-containing material, to which water may be added if necessary in a thin film on a clean microscope slide or cover glass Let it dry Then grasp the glass with tweezers and pass it bacteria side up through the flame of a bunsen burner or alcohol lamp three times taking about one second for each passage All bacteria will then be killed and fixed, and you are ready for the next step staining

There are many stains suitable for bacteria, some of a general type to make any bacterium easy to see and others of a selective type to color some bacteria and not others thus helping the microscopist to tell one from the other At first you probably will find it sufficient to use a single easily handled stain such as Loeffler s methylene blue

To make this mix thirty cubic centi meters of a saturated solution of methylene blue in ethyl alcohol with 100 cubic centi meters of water to which two drops of ten percent potassium hydroxide solution have been added. Now lay the slide or cover glass on a level surface and drop enough stain on it to cover the bacteria material. Let the stain act for from three to five minutes and then rinse in clean water

Often a dye will stain bacteria better if the glass is heated enough to make the dye solution steam but not boil, as it is dropped on.



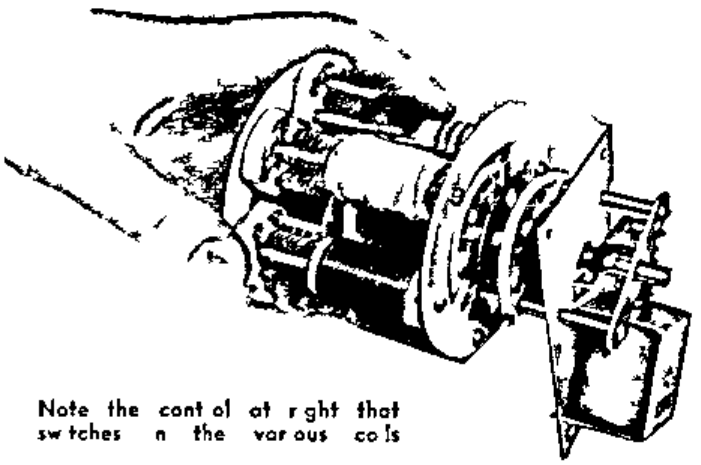
Having stained the bacteria specimen, you are ready to apply a cover glass if your specimen is on a slide or slide if on a cover glass For permanent mounting use neutral Canada balsam readily avail able specially prepared for slide making Place a drop of the balsam on the stained film and lower a thin cover glass in place on top of it.

In examining your slides under the micro-scope refer to the drawings on this page or to a book on bacteriology to help you spot the distinctive shapes and arrange ments of bacteria that reveal their identity

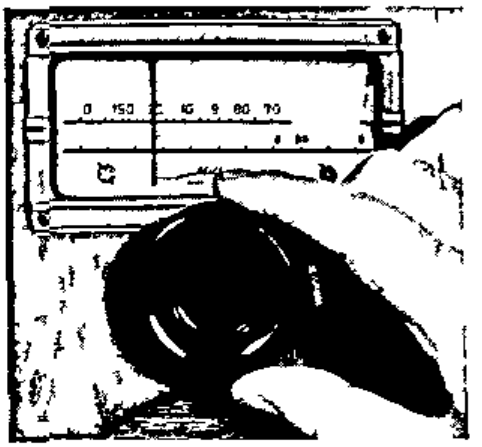
Latest Aids for

Push-Button Switch Controls New Five-Coil Wave Unit

CONTROLLED by an electric push button mounted at any convenient spot on the transmitter panel a compact set of five coils covering 10 20 40 80 and 160 meter bands instantly switches over to any one of the bands when the push button is pressed. The time and trouble saving device shown in the illustration below shifts bands through a magnetic or solenoid coil mounted on the assembly itself The tuning coils are set radially around the unit and each has its own midget 35 mmfd. tuning condenser which is pre tuned for complete band switching



Note the control at right that switches in the various coils

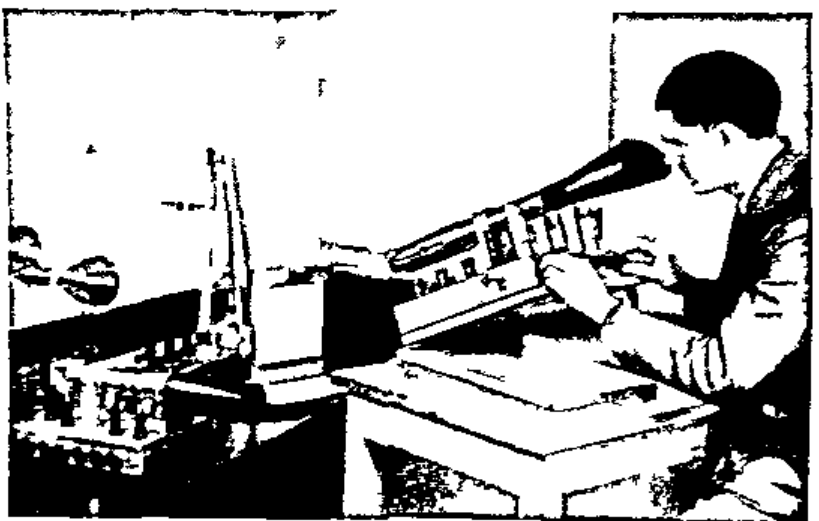


New Weighted Knob Simplifies Tuning

CALLED an inertia tuner the knob shown above attached to the tuning shaft of a receiver is made of heavy metal and is two inches in diameter Because of its weight and size it continues to spin when given a twirl thus reducing the amount of manual knob twisting necessary to swing between widely spaced wave lengths The knob has a $\frac{1}{4}$" hole to fit most tuning shafts. On either the main tuning or band spread shaft, it gives a smoother touch to tuning

Television Camera Tube for Amateurs

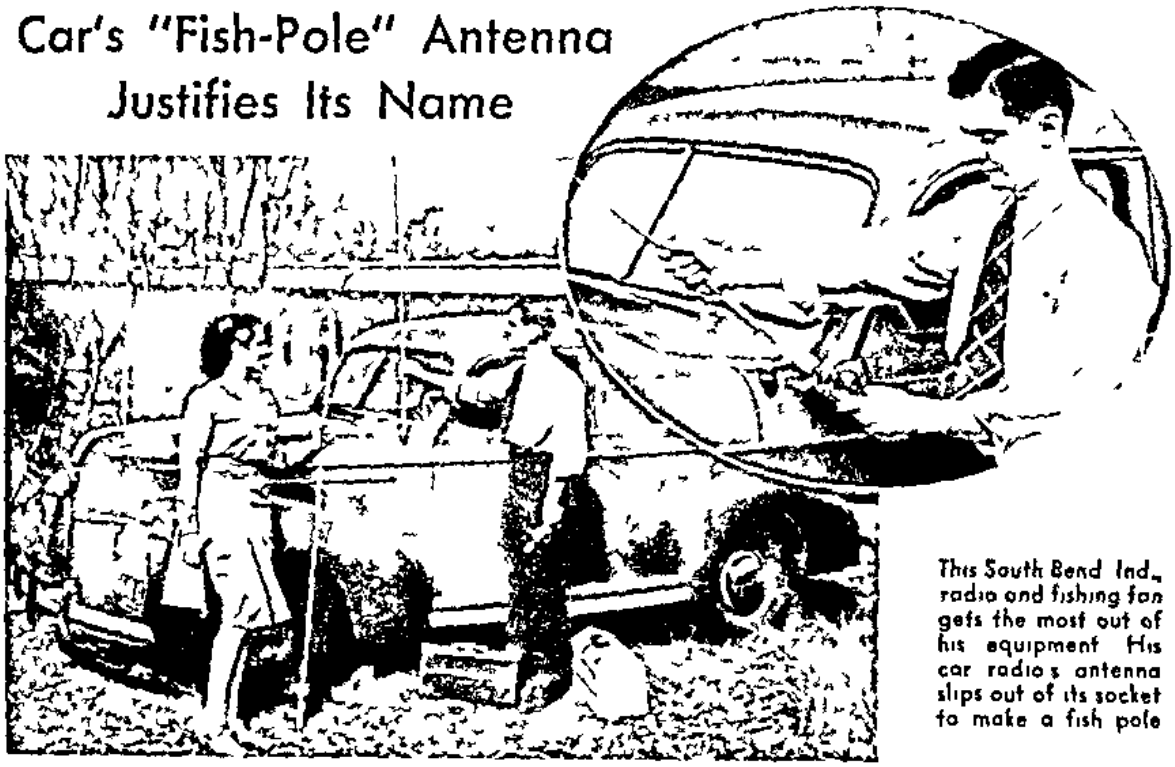
RADIO amateurs who would like to experiment with television transmission as well as reception can now do so with a new inexpensive television camera eye tube just placed on the market. The new tube is capable of transmitting a television picture $1\frac{1}{2}$" square composed of 120 lines According to the law anyone holding a radio amateur's license can operate an amateur television transmitter on the $2\frac{1}{2}$ meter and shorter bands



An amateur telecasting his call letters with the television transmitter

Radio Enthusiasts

Car's "Fish-Pole" Antenna Justifies Its Name

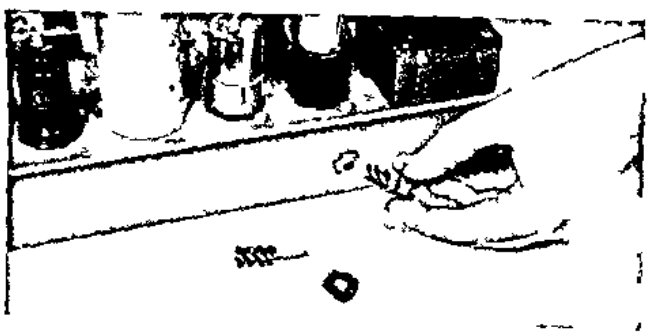


This South Bend Ind., radio and fishing fan gets the most out of his equipment His car radio's antenna slips out of its socket to make a fish pole

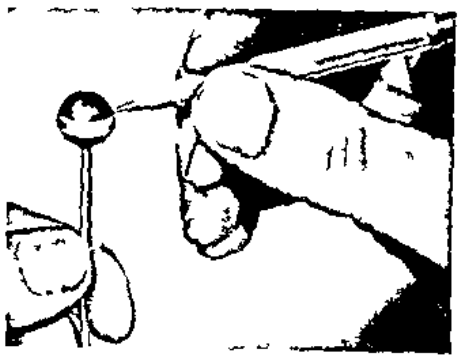
THE "fish-pole" antenna on the cowl of a South Bend, Ind, radio fan's car actually is a fishing pole Finding it gave him good reception, he fitted a regular steel fishing pole in the antenna socket Now, when he arrives at a stream, he removes the pole from the car, inserts it in its regular rod butt, and is ready to fish

Spiral Jack-Cleaning Brush

DESIGNED for cleaning dust or corrosion from the insides of radio jacks, a small spiral brush that fits the chuck of an ordinary hand drill is now available Inserted in the jack and revolved, it quickly wipes all surfaces clean



One of these tiny brushes will clean out a jack in a jiffy



Static Muffler for Automobile Radio

STATIC electricity that ordinarily collects at the tip of pole antennas on automobiles discharging with a violent crackling sound in the receiver, is said to be discharged gradually by the new antenna tip illustrated above The static 'muffler" consists of a small plastic ball girdled by a metal ring around its center The metal ring, by allowing any static charge to leak off slowly, eliminates most of the annoying discharge noises

Get Started in

WITH A FEW INEXPENSIVE PARTS YOU CAN BUILD SIX CIRCUITS DESIGNED TO TEACH THE TRICKS OF SET BUILDING AND REPAIR



Any good radio supply store has the parts listed at the right With them you can build this circuit and five more to be described in the next five issues

WHAT TO BUY

Line cord 135 or 160 ohm	.29
Filter choke 20 h., 500 ohm	.29
Coils plug in 100-570 meters (2)	.85
Variable condenser, 00014 mfd	.55
Mica condensers (2) 002 mfd	42
Mica condenser, 0002 mfd	15
Mica condenser 0005 mfd	.15
Dual electrolytic condenser, 16-16 mfd., 250 v	97
Shielded paper by pass condenser 1 mfd., 200 v.	.13
Tubular paper condenser, .006 mfd., 600 v.	07
Electrolytic condenser, 10 mfd., 25 v.	.24
Pentode-triode tube 2S8GT	75
Pentode-rectifier tube 70L7GT	75
Carbon resistors (4) ½ watt 1 meg	.40
Carbon resistor, ½ watt, 200 000 ohm	.10
Carbon resistor ½ watt, 150 000 ohm	10
Carbon resistor, ½ watt 600 ohm	10
Variable resistor 25 000 ohm	.28
Variable resistor, 250 000 ohms	.28
Six inch magnetic speaker	88
Four inch dial	.26
Octal molded sockets (2)	48
Six prong molded socket	18
Rotary 5 P.S.T. switch	16
R. F. choke 2.5 mh	.12
	$8 95

By ARTHUR C. MILLER

IF YOU have always wanted to experiment with radio here's your chance With the parts listed at the right, costing about $8 95 you can build six modern radio circuits—six different radio hook ups specially designed not only to use the same parts but to provide a good course in general radio construction and theory

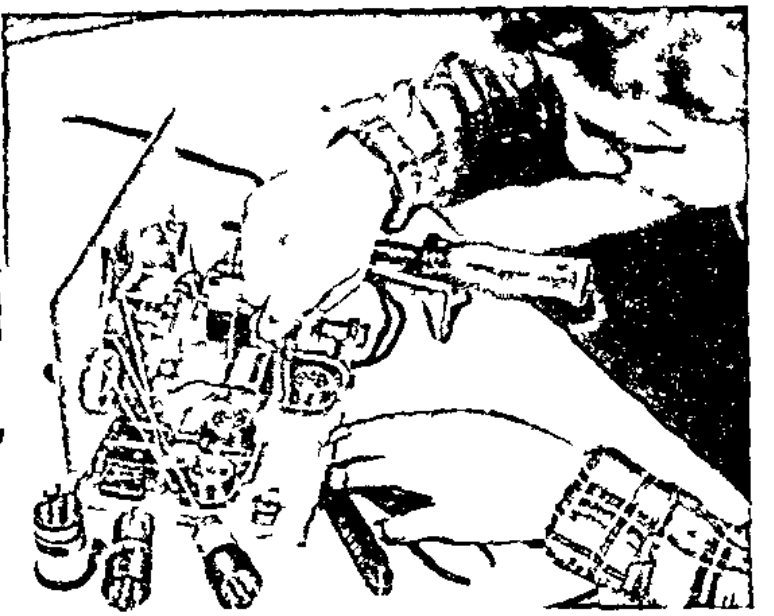
The first circuit described in this article, is a simple two-tube all-electric earphone receiver Next month, information on a three-tube all-electric earphone set will be given and in succeeding months a four-tube speaker receiver, a three tube phonograph amplifier, a three-tube tuned radio-frequency circuit, and a four-tube tuned radio-frequency receiver will be described. After purchasing the parts listed, together with the necessary connecting wire, fuse clips,

♦ TWO-TUBE ELECTRIC ♦ THREE-TUBE ELECTRIC ♦ FOUR-TUBE ELECTRIC

Radio for $8.95



A few of the items you need. Straight assembling a two tube all electric broadcast receiving set the first in a series of six



metal panel wood base board and solder you will have nothing more to buy

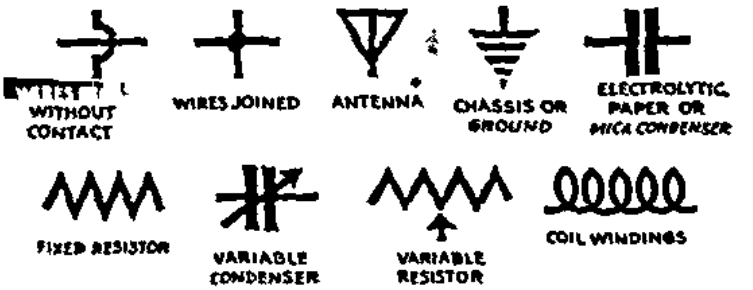
Two tubes of the latest dual purpose design provide all the tube elements needed in any one of the six circuits The 25B8GT provides a high frequency pentode and a high amplification triode The 70L7GT provides a half wave rectifier and an output pentode Both tubes have octal bases with eight pins or prongs

Before going on to the construction of the first receiver it will be well to review a few pointers on radio construction in general First of all use only high grade parts and make sure that they match the specifications Second don't manhandle the parts —remember they have to last for six different circuits Third always keep your soldering iron clean and use a solder with a resin core

The first receiver in this series of six is a two tube outfit designed to operate on either alternating or direct current of 110 or 115 volts For these voltages a line cord having a built in resistance of 135 ohms is used and is the right value for all six circuits If the line voltage in your home is 120 volts a 160 ohm line cord must be used

In this circuit the pentode section of the 25B8GT is used as a regenerative detector (the triode is not used) while half wave rectifier in the 70L7GT supplies the rectified current for the receiver (See next page)

SYMBOLS



NOTES

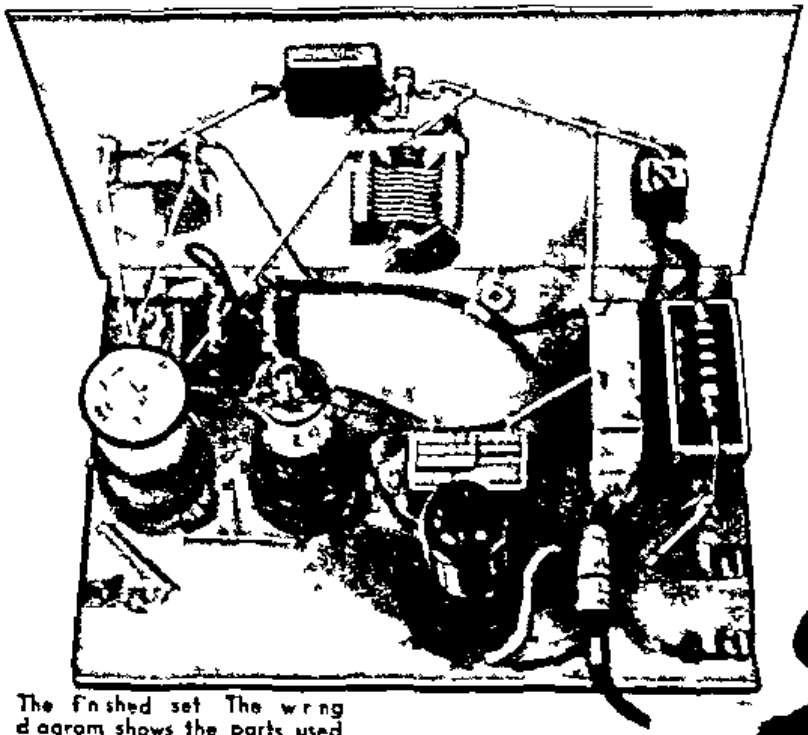
In conventional radio wiring diagrams, symbols are used to indicate the various parts such as condensers, resistors, and coil windings. The most common symbols are shown above. Abbreviations also are used to indicate the specifications of the parts. The most common of these are: mfd., microfarad mmfd., micromicrofarad meg., megohm mh., millihenry and H, henry

Three holes drilled in the metal panel receive the 25 000-ohm variable resistor (used for controlling the regeneration), the 00014 mfd tuning condenser and the rotary-type switch. All other parts with the exception of the 0005 mfd. fixed mica condenser (shown mounted above the tuning condenser), are placed on the wooden baseboard.

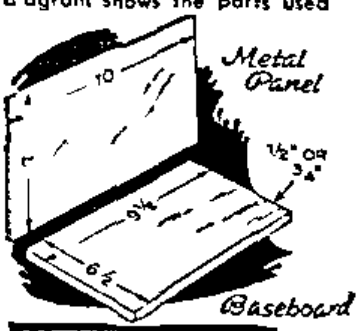
As all the parts will be used over and over again, take care in mounting the resistors and condensers. Also when buying the parts remember that fixed resistors and condensers with "pigtails" cannot be used.

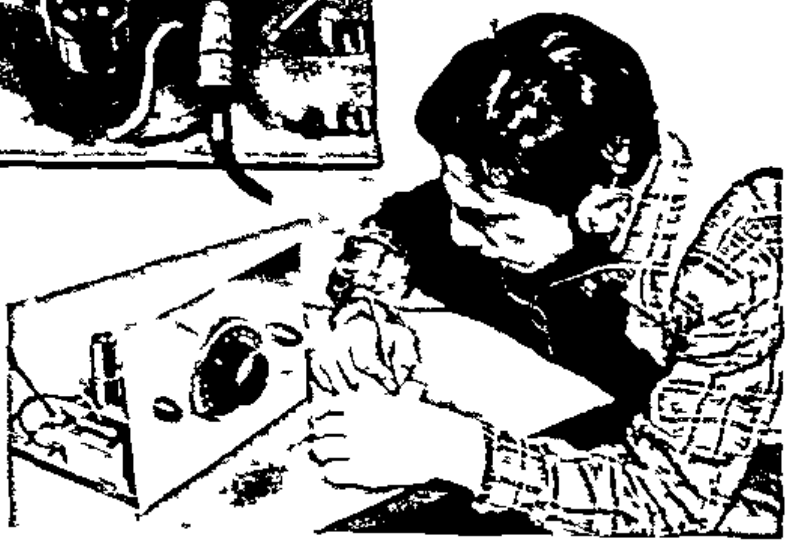
The electrolytic condensers can have flexible leads since they can be mounted in the same place in each circuit, but the resistors should be mounted in clips like those used for small fuses.

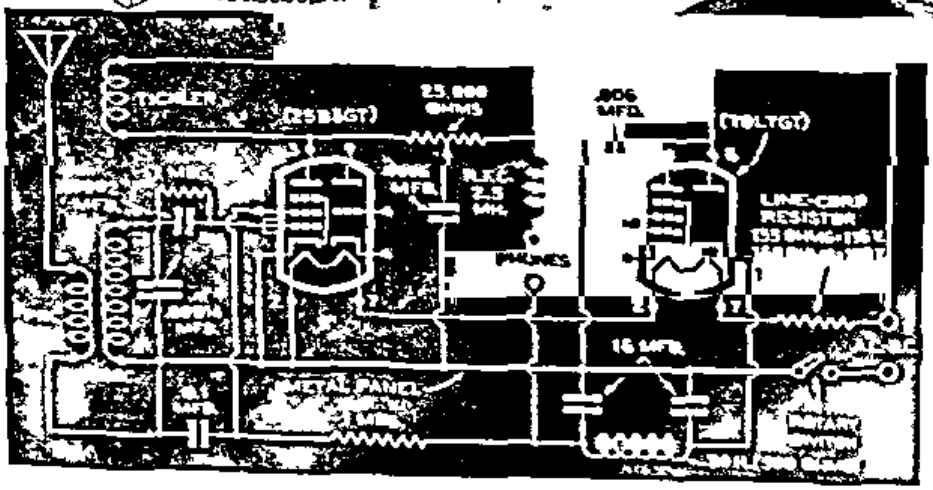
As this is an A.C.-D.C. receiver, no ground is needed the circuit being grounded through the house lighting system. Any type of antenna up to 80' in length can be used. For the reception of local stations an indoor antenna approximately 25' long will be found sufficient. It is not advisable to use a long antenna for receiving short wave signals.

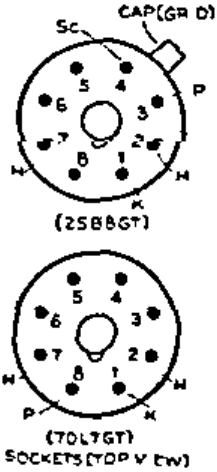


The finished set. The wiring diagram shows the parts used









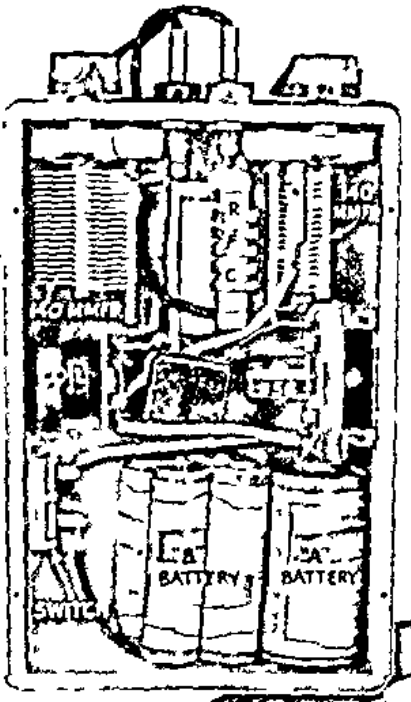
Pocket Receiver

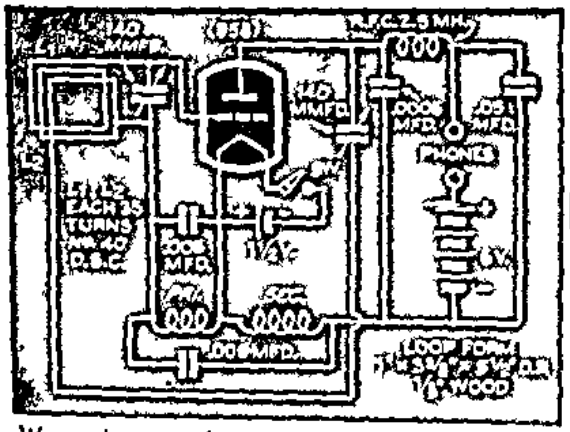
FOR SPORTS FANS



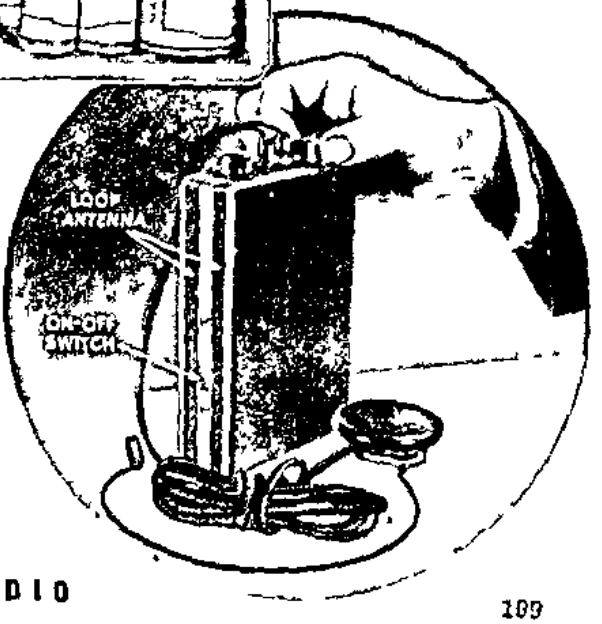
You can stow this midget receiver in a coat pocket. Note the parts arrangement at the right. Cigar-box wood forms the cabinet, and a loop antenna is wrapped around it, while flash light cells to power the set are carried in the base

LITTLE larger than a tobacco tin, the pocket receiver pictured below is ideal for sports fans who want to hear the play-by-play broadcasts while watching a game or meet from the stands. The set employs a super-regenerative circuit, using a 958 tube that operates successfully on very low plate voltage. Around the cigar box-wood case, a loop antenna is wound consisting of thirty-five turns each side of center, with both sections wound in the same direction. Use No. 40 D S C wire. The two 140-mmf variable condensers, of the air-padder type, should be mounted with screws before the loop is wound. A brass bushing ¼" in diameter and ⅜" long is soldered to the stub shaft of each condenser. A medium-size flash light cell serves as an "A" battery, while the "B" is composed of four "fountain-pen" cells in series. The latter should last almost indefinitely as the drain is very small. Although the set is decidedly not a distance getter, since it has limited voltage and only a tiny directional loop, it should give good results up to fifty miles on the bands between 650 and 1260 kc.



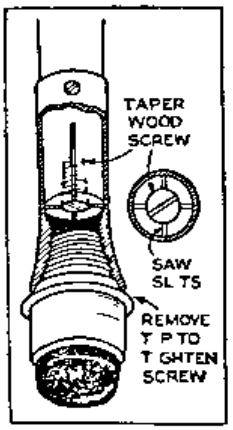


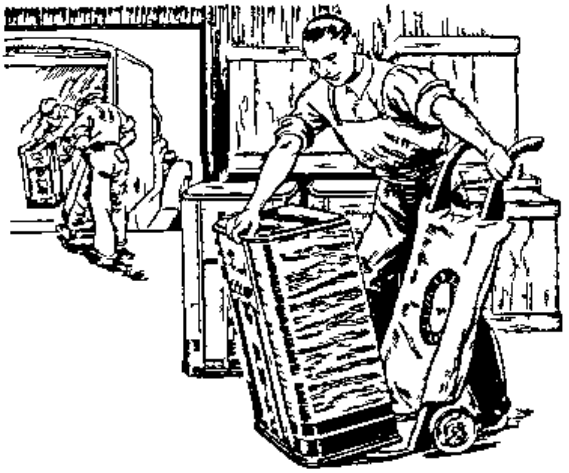
Wiring diagram also gives full parts specifications



Taper Wood Screws Keep Crutch Sockets Tight

ANYONE who uses crutches with sockets of the type shown knows how annoying it is when the wood shrinks and the loose sock ets clank at every step To cure this I bought a couple of taper wood screws re moved the sockets from each crutch and drilled a hole in the end of the wood a little deeper than the length of the screws and a trifle larger than their small ends Then I sawed two slits at right angles through the holes and as deep as the holes I re moved the part of the socket holding the rubber tip and placed the sleeve over the end of the crutch A turn of the screw spreads the split end and holds the sleeve firmly — A J PICOLET



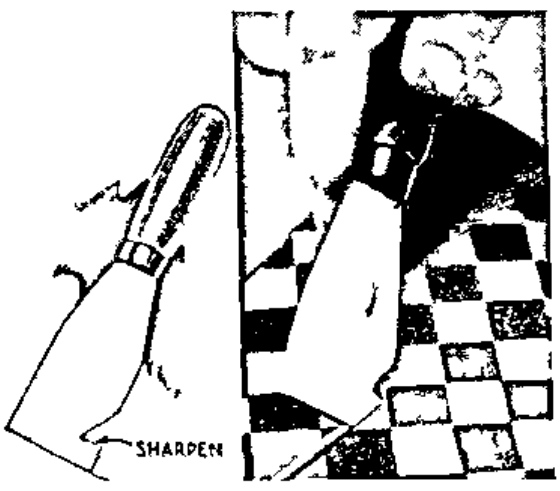


Heavy Burlap Sack Pads Edges of Hand Truck

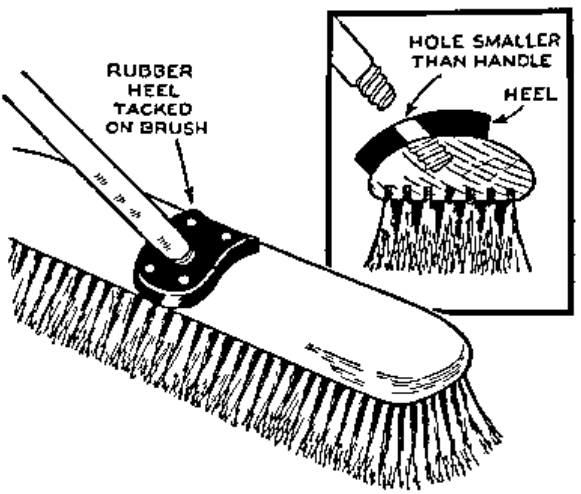
WHEN a hand truck of the two wheel va riety must be employed to move furniture baggage or any easily scratched merchan d se about a warehouse cut two holes in the bottom of a heavy burlap sack and slip this over the truck as illustrated

Linoleum Cutter Made from Putty Knife

A LINOLEUM cutter can be made by cut ting a notch near the end of a first class putty knife One edge of this notch is sharp ened and the knife is used as shown below It has several advantages over an ordinary knife Circles squares and other shapes can be cut as well as straight lines after you have had a l ttle experience in manipulating the cutter —WAYNE R PIERCE



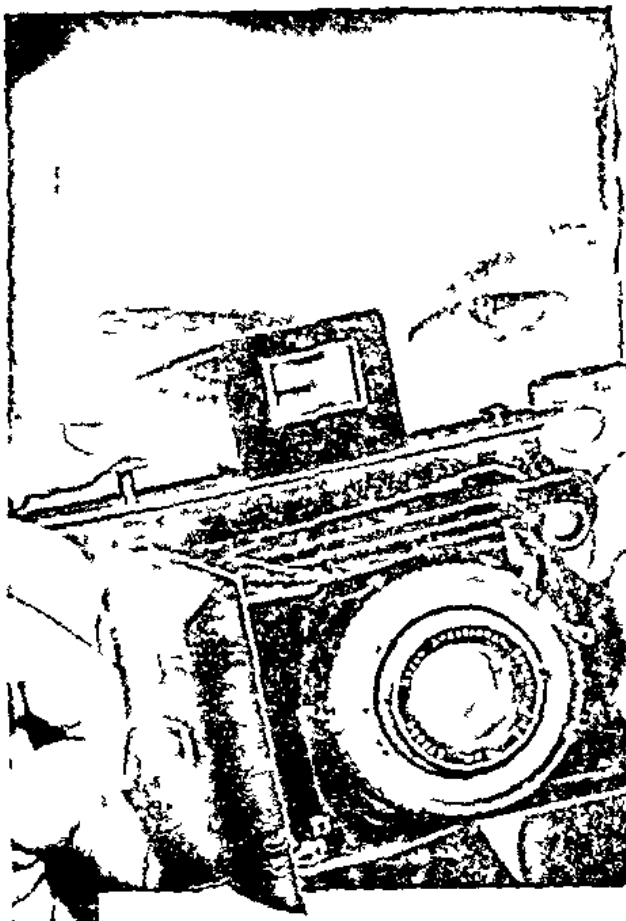
The altered putty kn fe and method of us ng t A sharp edge s necessary to cut a clean l ne



Rubber Heel Stops Brush Handle from Unscrewing

A SCHOOL janitor who was inconvenienced because the handle of his horsehair floor brush often loosened and parted company with the brush cured the trouble without the use of nails or screws by the simple method shown above He tacked an ordinary rubber heel on the brush after cutting a hole through it somewhat smaller than the screw hole in the wood block Forced into place through the rubber the handle is firm ly held by friction no matter how long or vigorously the brush is wielded

KODAK VIGILANTS



"First family" of the moderate-price camera clan... eight models $14.50 to $42.50

PICTURES ARE BIG . . . 2½ x 4¼ inches with the Six-16's, 2¼ x 3¼ inches with the Six 20's FEATURES ARE MODERN Single push button for opening and closing Waist level and eye level view finders Retracting body shutter release Extra rigid lens support. LENSES are genuine Kodak Anastigmats And the SHUTTERS, all highly accurate and reliable, include Eastman's new nine speed Supermatic

See these finest of moderate-price folding cameras at your Kodak dealer's Go over them "with a fine tooth comb," and you will agree that rarely has so little money bought so much picture taking ability

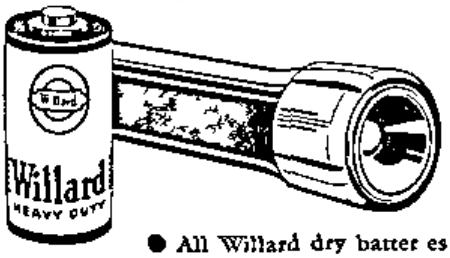
• • •

PRICES: Kodak Vigilant Six 16, *f*/8 8 lens, $16 *f*/6 3 lens, $19 50, *f*/4 5 lens, $29, *f*/4 5 Special lens, $42 50 Kodak Vigilant Six 20, *f*/8 8 lens, $14 50, *f*/6 3 lens, $17, *f*/4 5 lens, $25, *f*/4 5 Special lens Supermatic shutter (illustrated), $37 50 Eastman Kodak Company, Rochester, N Y

GOING TO THE NEW YORK WORLD'S FAIR?—Take your Kodak—visit the Kodak Building—see the Greatest Photographic Show on Earth

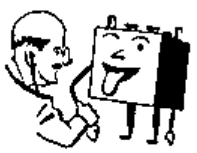
Only EASTMAN makes the KODAK

Announcing
Willard
DRY BATTERIES and FLASHLIGHTS
New, Long lasting batteries for all purposes



● All Willard dry batteries equal or *exceed U S Bureau of Standards specifications* Dated fresh at the factory For your flashlights radio or other use ask for these new *More for Your Money* Willards.

Safeguard Your Car *against Starting failures*



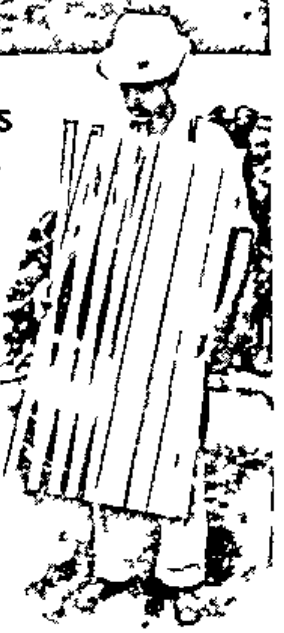
● Most starting failures are caused *not by the battery* but by little things like worn or undersize cables loose connections or faulty wiring that drain the life out of a perfectly good battery Your Willard dealer has a new Starting Service instrument that X rays the entire starting system of your car—locates hidden leaks and flaws before they cause trouble A Willard Starting Service check up takes only a few minutes and will save you many a dollar—try it!

SEE OPPOSITE PAGE...

Willard
YOUR ASSURANCE OF QUALITY



Small Trellis Opens to Fit Any Space



ADJUSTABLE for use in spaces up to 18 long this trellis may be placed wherever a support for climbing plants is required and bolted to posts set at either end The strips are sawed from a 1" board and are $1\frac{1}{4}$" by 4 Holes for the rivets must be drilled accurately so the trellis will fold up compactly for storage Finished with two coats of good white paint the trellis will last for many years —B N

Toothbrushes Converted into Tool Handles

WHEN the wooden handle of my draftsman's erasing knife split for the second time I replaced it with a brilliant clear red celluloid toothbrush handle It took but a few moments to saw off the brush and drill a hole in the cut end to fit the tang of the knife snugly A little celluloid dissolved in acetone was dropped into the hole and the tang pressed firmly in The idea was so successful that I have applied it to all the watchmaker's files on my bench For larger tools two handles may be faced off and cemented together with the acetone cement Marks can be removed with a file and scraper A beautiful polish may be obtained with a buffing wheel loaded with crocus or jeweler's rouge —R B R.

New improved Willards give you 4 *Extra* advantages *at* NO *extra cost!*





LONGER LIFE

10-15% more miles and months—Former Willards were noted for power and long life but these new Willards are still *better* This year, Willard engineers have outdone themselves with a new, greatly improved line of batteries that give 10 to 15% longer average life than former Willards—and at *no* extra cost

MORE RESERVE POWER

Plate materials increased 7 9%—Heavier elements go into each cell of the new Willard batteries—either thicker plates, heavier plates or more plates That means not only more life but more reserve power These new Willards easily handle the extra current demands of modern cars—and like it.

GUARANTEED CAPACITIES

You know what you re getting—Willard has clearly and permanently molded the guaranteed ampere hour capacity in the case of each new Willard battery It s in plain sight. You *see* exactly what you are *getting* And you pay *only* for what you get. It s a guarantee of *full* measure of battery value for your money

"SAFETY-FILL" CONSTRUCTION

Stops Dangerous Corrosion

No acid spray on motor and wiring—With Safety Fill, your Willard battery never drinks too much It s very simple Very effective This exclusive new device prevents overfilling—definitely protects your automobile against corroded cables and terminals that cause current losses and unexpected starting failures

Your Willard dealer has these NEW batteries now Look for his red-and white Willard sign, or the name Willard in the classified section of your phone book under 'Batteries

WILLARD STORAGE BATTERY COMPANY

Cleveland • Dallas • Los Angeles • Toronto

Willard

SAFETY-FILL BATTERIES

STOP DANGEROUS CORROSION

MORE BATTERY FOR YOUR MONEY!

TOMORROW'S DRIVING WILL BE

"Fluid-Driving"!

A CHRYSLER First

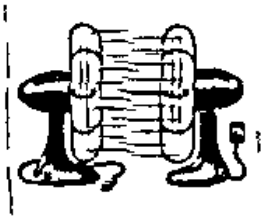
THEY'LL ALL FOLLOW!



WHY SHIFT GEARS?

Drive the new and thrilling way — the *Fluid Drive* way. It's all fun and no work. You just touch the throttle to go — touch the brake to stop. *Fluid Drive* is the drive of tomorrow but you can enjoy it in a Chrysler now. Try it — see your Chrysler dealer today.

★Tune in on Ma or Bowes CBS Thurs 9 to 10 P M E D S T



SIMPLE AS THIS!

Air from a running fan will set an idle fan in motion as a breeze turns a windmill. That's the principle of *Fluid Drive*.



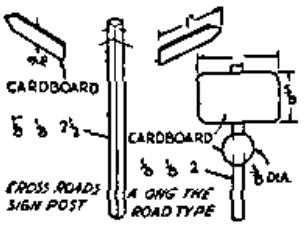
SMOOTH AS OIL!

One fan-like wheel drives another by forcing a current of oil against it. Smooth as oil, because it *is* oil. No rigid metal connections. Can't jerk.

be modern BUY CHRYSLER!



Two Authentic Signposts for Model Railways



ACTUAL signs were copied in making these model - railway accessories. The lettering is either applied directly to the signs or first drawn much larger on a sheet of paper and then copied with a camera. For those not adept at hand lettering the second method has the advantage of minimizing any flaws.

Locate the crossroads signposts where roads intersect each other and the along the road type between road intersections. Holes drilled in the platform or small tin squares nailed to the bottom of the posts will keep the signs upright. Both the signs shown in the drawings are scaled for O gauge.—C. ELMER BLACK

Turning Wooden Rosettes

ROSETTES may be turned quickly on the lathe if a smooth board is first attached to the faceplate with a small brad projecting from it in place of a center screw. Start the lathe and hold a lump of rosin against the board over the surface to be covered by the rosettes. The friction will melt the rosin. Then hold the turning stock lightly in one hand, set it on the brad and with the other hand press it down against the faceplate firmly but slowly. In an instant the rosin will melt between the surfaces and the rosette will stick. After the rosette has been turned tap it with the handle of a chisel and it will drop off. Stick on another piece of stock and repeat the process without stopping the lathe.—J. J. EDWARDS



RAILWAY EXPRESS — *SYMBOL OF DEPENDABLE SERVICE... USES DEPENDABLE*

CHAMPION SPARK PLUGS!

IN CITIES AND TOWNS all over the United States the familiar Railway Express truck is a symbol of dependable, speedy, safe delivery Over 12 000 of these trucks are constantly on the go regardless of weather Dependability is the watchword

This giant fleet has used Champion Spark Plugs for years Here is just one more outstanding proof that Champions make every engine a better performing engine—one more sound reason for you to insist on dependable Champion Spark Plugs for your car

Only Champion Spark Plugs have the Sillment seal which keeps them permanently free from troublesome leakage common to ordinary spark plugs Since only one leaker in a set will cause rough, uneven, wasteful engine operation, it is obvious that Champion s leak proof qualities are necessary to maximum performance and economy

Profit by the experience of the nation s largest and most efficient fleets—of the world s racing champions on land, water and in the air—by insisting on Champions for your car

MODEL BUILDERS—ATTENTION!

ACTUAL SIZE V PLUG



65¢

Champion Spark Plugs for model gas engines give the same dependable performance as the regular Champions. Sillment sealed Sillmanite insulator Alloy needlepoint electrodes for easy starting One piece construction

CHAMPION SPARK PLUG CO.
911 Upton Ave. • Toledo, Ohio

	V	V-2	V 3
Hex	1/2	3/8"	5/16"
Thread	3/8	14 mm-27	1/4" 32
Thread Length	7/32	3/32	5/32
Weight, Grams	8	3½	2½



Make More Things at Home with

KESTER METAL MENDER

You ll get a real kick out of increasing your skill as a craftsman with Kester Metal Mender You can build more things and make them better when you have a can of this handy home solder on your work bench Time and again you'll find that the easiest way to make it is to *solder it!*

And the same thing goes for repairing anything made of metal Kester Metal Mender contains its own flux and makes perfect money-saving repairs every time All you do is apply heat and the job's done

Buy it at your hardware or other stores

For a sizable free sample of Kester Metal Mender and "How-to-Use-It" Booklet—*mail coupon now*



KESTER
METAL MENDER

You Can Paste this Coupon on a Postcard

Kes er Sol ler Company 473 Wrigh wood Ave Chicago 11
Please send me free samp e of Kester Metal Mende and How to-Use-It Book et

Name______________________________

Address______________________________

City___________________ *State*__________

Mail the Coupon Now

TESTED BLUEPRINTS

Solve Shop Problems

NO MATTFR what type of project you intend to build you will find that blue prints drawn to a definite scale and tested by experts will eliminate many of your workshop problems For eighteen years we have been supplying amateur craftsmen with a wide variety of plans Some of them are given below A complete list will be sent upon receipt of a self addressed stamped envelope

MODELS



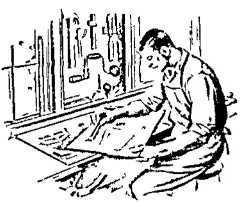
Brig MALEK ADHEL 20 hull frame and plank or sol d hull construction 301 305 306 R	1 25
C pper Sh p in a Bott e 121 124	50
Clipper Sh p SOVEREIGN OF THE SEAS 20½" h 51 52 53 R	1 00
Cody Coach 13 long 144 145 146 R	1 00
CONSTITUTION (Old Irons des) 21 hul 57 58 59 R	1 00
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(Continued on page 208)





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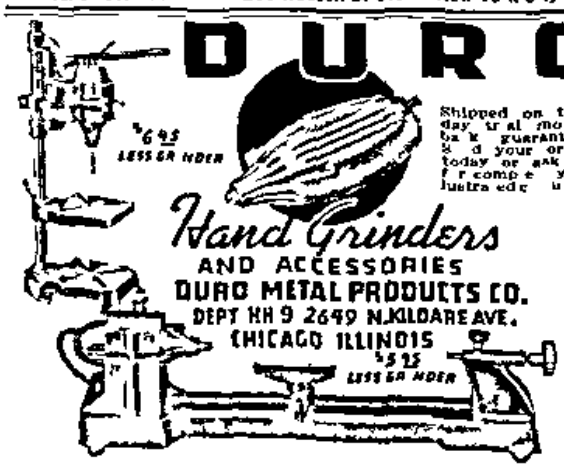
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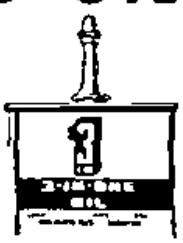
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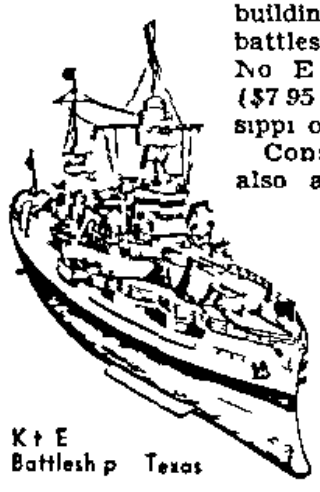


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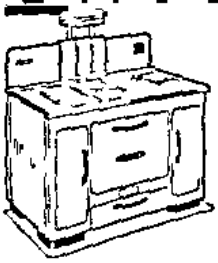
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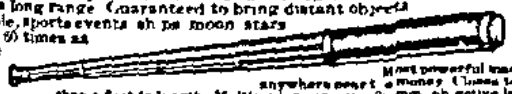
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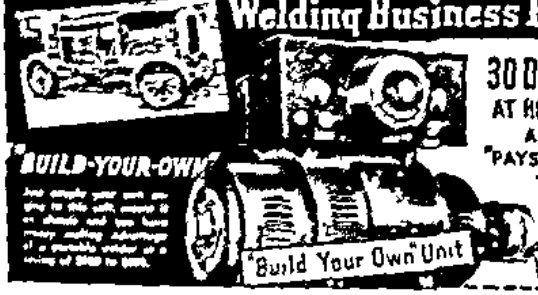
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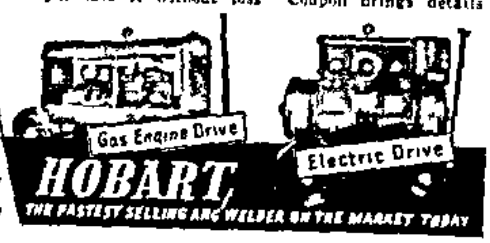
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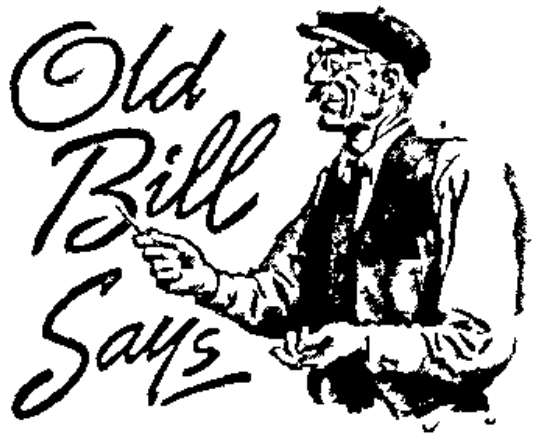
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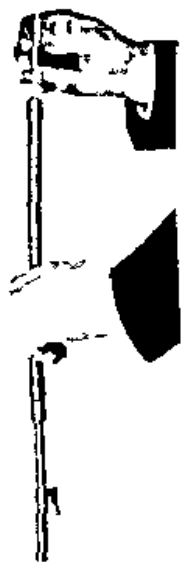
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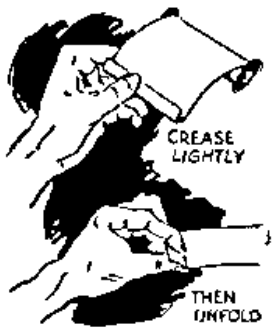
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In some cases, where the connecting wires pass through the neck, there may not be room for the addition of the stiffening wire It will then be necessary to remove the lamp cord and carry it to the socket on the outside —ARTHUR TRAUFFER



Inserting a copper wire to strengthen a lamp gooseneck

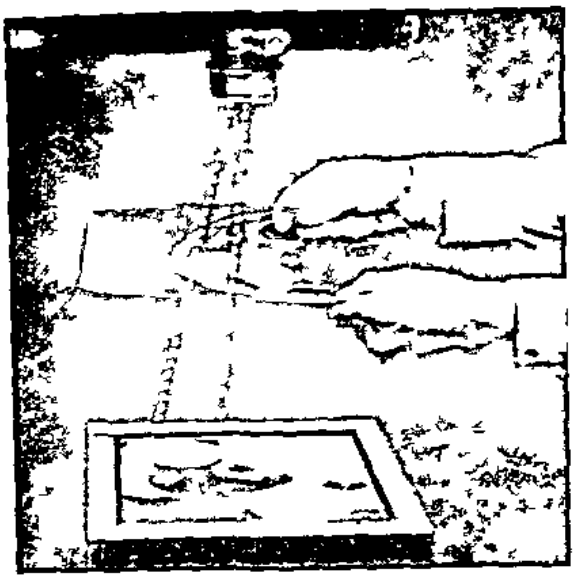
Making Roll Film Slide Readily into a Reel



MANY exasperating moments are spent trying to load film in a roll film tank reel These can be avoided by a very simple operation All you have to do is to crease the film lightly back on itself for about ¼ as shown Then unfold and thread on the reel in the regular way The crease offsets the natural tendency of the film to curl inward which makes the film so difficult to push along It also stiffens the film across its width eliminating any tendency to buckle The film will glide along the spiral groove almost as though rolling on ball bearings —H S THOENEBE

• • •

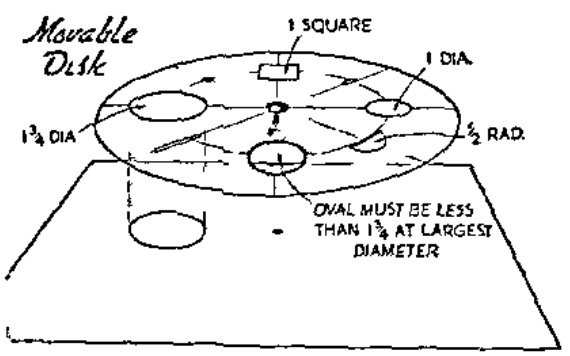
A STRING of ordinary Christmas tree lights with all red bulbs can be strung along a large darkroom not to serve instead of a safelight but to provide a guide for walking about. Each bulb must be provided with a half shade to reflect the light away from the working area —JOHN E HELLAWELL



Dodging Mask Provides Variety of Shapes

WITH its various openings this dodging mask will be found helpful in photographic enlarging It is made of two pieces of transparent celluloid (preferably red) or other cellulose material Large discarded photographic film if the emulsion is removed will answer the purpose admirably One piece is about 9" by 11", the other about 8 square If clear stock is used red cellulose wrapping tissue is attached to both pieces with rubber cement so the transmitted light will not affect the enlarging paper, which is not sensitive to red rays

The 8" square piece is then cut into a circle and openings are cut out with a razor blade as indicated One large round opening is cut in the main mask The two parts are assembled with a paper fastener so that any desired opening may be revolved into position over the circular opening in the rectangular mask —FRANK CAPOREAL.



Transparent red or red covered celluloid s used for cutt ng out the two parts of the dodg ng mask



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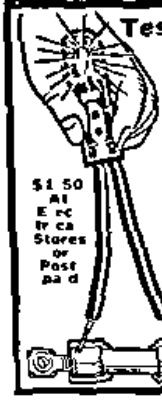
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How to File Negatives with Photo Data Cards

AMATEUR photographers who are using the file card system previously described in this department (P S M Feb 40 p 168) can keep the negative of a photograph on the same card with the remainder of the data provided the negative is smaller than the card This is done by a slight change in the method of mounting the contact print on the back of the file card Instead of being pasted on it is fastened with strips of masking tape along two opposite edges The negative is then slipped between the print and the card where it remains as if in an envelope This not only helps to centralize records but saves considerable time in the darkroom —THOMAS F CONLON

Tray Catches Developer Spilled from Tank

WHEN developing the largest size film a tank will accommodate it is necesary to fill the tank as full as possible Occasionally developer spills over the edge of the tank and is lost If however the tank is set in a clean tray the excess developer may be recovered —W W LEVIN



Field Trials for Dogs

(Continued from page 75)

the factors which control scenting conditions He constructed huge metal funnels containing delicate spider web diaphragms Sunk in the ground they proved that the earth literally breathes air passing out of the ground when it is warmer than the surrounding atmosphere and into the ground when it is cooler than the air Thus scenting conditions are best when the earth is warmer than the air

Near the spot where the Clinton course swings south along the stream one of the pointers locates the first bird It freezes instantly The judges note its pointing style Both head and tail should be held above the line of the back Then its trainer moves in raises a pistol and fires a blank cartridge over the back of the pointing dog Every animal entered in the meet must pass this test to prove it is not gun shy

As soon as they break out of the woods the two pointers rush this way and that among the bushes and planted patches of grain Each animal has its individual manner of covering an area The pattern made by its zigzagging course is carefully noted by the two judges If a dog bolts straight through an area or circles it without thorough investigation it is penalized

Spectators on the hillside watch the dogs intently From the let 'em go' of the break away to the Take 'em up' of the finish a field trial is often a nip and tuck struggle and the minutes in the meadow are among the most vital in the contest Time after time the dogs stiffen scenting the pheasants which have just been released or others previously let loose The judges have their watches out The contest has narrowed down to seconds Then one of the pointers hushes a bird and breaks after it, chasing it half across the field in spite of the owner's frantic blasts on the whistle That blunder gives the higher score to its more steady bracemate

A few minutes later while these two pointers are being carefully rubbed down, another pair begins the circuit of the course So the contest continues hour after hour There are exciting upsets stirring exhibitions of training and skill And finally at the green trailer which forms the temporary headquarters of the club solid silver plates are awarded to the winners These animals the product of scientific breeding and training have demonstrated the greatest degree of speed scenting ability and stamina—the three outstanding requisites of the field trial champion

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Can We Defend Our Coasts?

(Continued from page 97)

their anchors and control wires stored and the mines laid at the outbreak of war Contact mines are used to block off the parts of harbor entrances which need not be used by friendly ships Controlled mines are used to guard entrances which must be used by friendly shipping and which are within range of the harbor defense guns and searchlights which protect the fields against sweeping The electrical control apparatus may be set so that a mine will explode the instant that a ship comes in contact with it or so that the mine will signal that it has been struck and then will explode after any desired number of seconds—a method which makes it fairly certain that the mine will explode while it is in contact with the bottom of the ship Until its firing switch is closed a controlled mine is harmless

During the peaceful years that followed the end of the World War the Coast Artillery like the rest of the Army suffered from the starvation diet imposed on it by inadequate appropriations Our coast defense system which had been one of the world's best was allowed to go downhill In 1936 increased appropriations made it possible for the Coast Artillery to start improving our Panama Canal and Hawaiian defenses Our Pacific Coast harbor defenses also were improved But until about a year ago our Atlantic and Pacific seacoast defenses were in a decidedly unsatisfactory condition Since then steady progress has been made in improving them Some fortifications have been modernized and undisclosed number of new guns have been mounted and the defenses against attack from the air have been tremendously increased But we haven't gone nearly far enough We need more guns and we need more highly trained coast artillerymen to handle them

Harbor defenses can't be improvised in an emergency It takes close to three years to build a battery of heavy guns Strong harbor defenses aren't likely to be attacked from the sea because the loss in irreplaceable ships would be too heavy Weak harbor defenses guarding important ports and *cities are an almost irresistible* temptation to an enemy fleet especially at the beginning of a war Even if our coast defenses never have to fire a shot their cost will be a very low priced insurance premium for the protection they give

Flyers by the Ten Thousand

(Continued from page 49)

legians Only one scholarship winner in each course may be a woman Those who accept scholarships must pay an additional fee of twenty dollars to cover the cost of physical examination and required insurance

About 7 000 students started the ground courses early in January of this year and over 700 winners of C A A and privately offered scholarships together with non winners who are paying their own flight instruction costs of about $300 now are receiving flying instruction It is expected that by the end of August nearly all of them will have completed their courses and received licenses

Women college students showed as keen interest as the men did when the courses were announced last year Forty students in four women s colleges were accepted and 324 girls in coeducational institutions A large proportion of them made the grade although the percentage of those who failed to win licenses was almost twice as large as that of men Ground course instructors told me that the girls usually had to work harder than the men because they weren t so strong in mathematics One flying teacher said that although all four of the girls in his classes got through all right they were considerably more nervous than men and a little slower to learn

The ground course which consists of seventy two one hour lectures instructs the students thoroughly in the history of aviation flight theory the C A A regulations air navigation meteorology the use of parachutes the aircraft power plant instruments and radio To go on to the flight course the student must pass an examination with a minimum mark of seventy in each subject

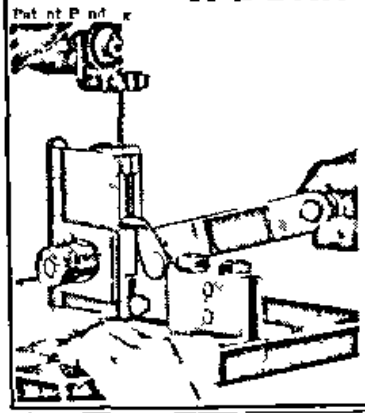
The flying course is given by a C A A approved operator who must provide one instructor and one instruction plane for each fifteen students at an airport convenient to the college It is divided into three stages—a minimum of eight hours of dual instruction a minimum of three hours of preliminary solo flying with one hour of check flight and a minimum of fifteen hours of advanced solo work with eight hours of dual instruction as a check

C A A instructors devote the first flying lessons which are given on the ground to making the students feel at home in the plane and to simple explanations of the controls and instruments All instructors agree that nervous and muscular tension is the

(Continued on page 220)



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Flyers by the Ten Thousand

(Continued from page 219)

most deadly enemy of good flying. They are alert for indications that the student is choking the stick—getting a drowning man's clutch on the control. This prevents the development of the delicate feel by which good pilots fly.

During early dual flights the instructor, in the front seat, demonstrates simple maneuvers and the student follows his movements on the dual controls. Then the student is allowed to fly the plane except when taking off and landing with the instructor ready to take over if he makes a serious mistake. In the later lessons of the dual instruction stage the instructor demonstrates spins and simulated forced landings and the student is permitted to make into wind take offs, and into wind landings without power.

As soon after the minimum eight hours of dual instruction as the teacher thinks he is competent, the student makes his first solo flight. He devotes at least six half hour periods with as much dual check instruction as his instructor thinks desirable to practicing level flight turns, glides and other elementary maneuvers. Then he goes on to advanced solo flight and devotes fifteen hours in the air, checked by eight hours of dual instruction, to precision landings, stalls and spins, power turns, cross-wind take offs and landings with power, and other advanced maneuvers leading up to a fifty mile cross country solo flight over a triangular course and finally to the examination for his private pilot license.

The Civil Aeronautics Authority's pilot-training program has been sensationally successful in training a large number of pilots with a hitherto unknown degree of safety. It is expected that during this coming year at least 600 colleges will offer C.A.A. courses to their undergraduates and that there will be a proportionate increase in the number of noncollege courses. Many of this spring's graduates intend to enter Army or Navy flying schools after they have completed their advanced courses this summer.

Already the program has helped materially to increase the number of licensed pilots in the United States from 33,000 to 45,000 in less than a year. Aviation experts are confident that the expanded program will provide a large number of well grounded candidates for commissions in our naval and military air services and that many of its graduates will become pilots of the new fighting planes on which some day the safety of America may depend.

Is It Murder?

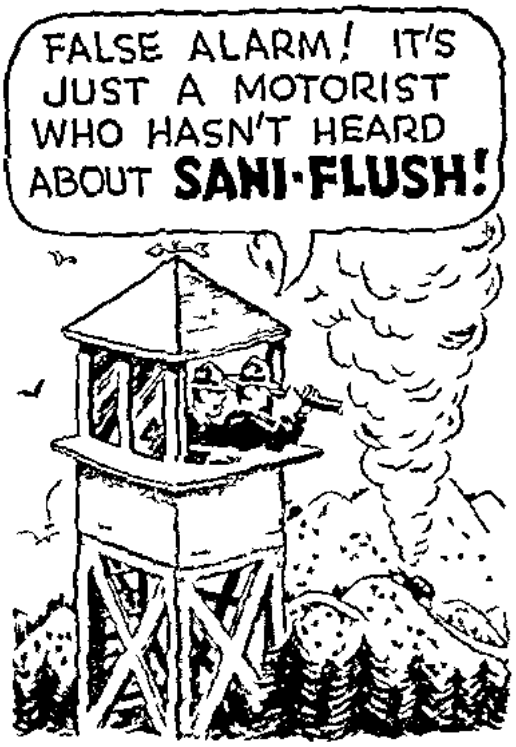
(Continued from page 71)

with pen pencil nor typewriter It was the impression left on a sheet of tablet paper when according to the husband the original had been produced on the woman s death bed He declared he had never been able to find the will itself but had discovered the tablet with the impression writing on it after his wife s death John F Tyrrell noted Milwaukee authority on questioned documents was called in to examine the ghost writing His ingenuity in *proving it could not* have been produced by the dying woman stands as a classic example of the resourcefulness of the modern scientific sleuth

Examining the tablet closely Tyrrell found that the impression was faintly visible down to the fifth sheet Yet when he studied the ordinary handwriting of the dead woman he noted that she used an extremely light touch The night before his appearance in court Tyrrell set to work with a piece of wire a tin funnel and a pencil First he mounted the pencil point downward in the bottom of the funnel Then he made a loop in one end of the wire and slipped the funnel into it With this simple apparatus and a bag of lead shot he appeared in court the next day

Pouring shot into the funnel a little at a time he pulled the weighted pencil along the tablet with a piece of string at the same time using the wire loop to keep the funnel upright without removing any of the load from the pencil point Three ounces of shot proved sufficient to produce a line comparable to that found in the known writing of the dead woman But *three additional pounds* had to be poured into the funnel before the pressure was great enough to carry the impression down to the fifth sheet of the tablet In other words the phantom document supposedly written by the dying woman would have required sixteen times more pressure than she used in normal writing when in full possession of her health and strength

The absurdity of that story was graphically disclosed by Tyrrell s simple demonstration Convicted of forging the note and of poisoning his wife the husband died in the penitentiary Like scores of other perfect crime killers who have sought to pass off murders as suicides he overlooked one thing—the skill and resourcefulness of the science using detective employing all the new discoveries of the laboratory as weapons against the arch criminal the cold blooded murderer who plots in advance to escape the consequences of his crime



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Grooming the Iron Cavalry

(Continued from page 101)

as the iron cavalry artillery must be motorized. The battalion attached to the brigade carries its gun crews in half track personnel carriers of the same type as is used by the machine gun troops and tows its 75 mm howitzers behind them. These howitzers have a range of five and a half miles—only about two thirds of the range of the 75 mm guns which they have replaced for cavalry use but the high angle lobbing type of fire and quick aiming characteristics make them decidedly useful to the Mechanized Brigade.

Accompanying the fighting vehicles is the train—big motor trucks loaded with drums of gasoline ammunition and food trucks which are fast moving machine shops mobile kitchens which cook as they roll. When the full brigade is marching on a single road its column stretches twenty miles from head to tail.

Ahead of and above the dust streaked gray green combat vehicles and trucks fly the planes of the observation squadron. In war their most important mission would be to obtain and report information about the enemy. On peacetime marches their main job is to watch the long column for gaps and to report them by radio. The commander of the iron cavalry Brig. Gen. Adna R. Chaffee—he is one of the Army's most brilliant cavalry officers and in his younger days was one of its top competitive riders—often controls the march from the air.

In an all motorized all mechanized force equipped with close to 600 vehicles many of them of exceptionally complicated character maintenance becomes a major problem.

When the brigade is on the move each troop is followed by its maintenance truck whose crew makes any roads demands it can handle. Regimental maintenance trucks follow each regiment and their crews take care of more serious breakdowns. At the tail of the column roll the trucks of the ordnance maintenance company—trucks loaded with spare parts and even spare engines. Mobile machine shop trucks a generator truck which provides electric lights for the field machine shop which is set up each evening in a big square tent. Wreckers tow disabled vehicles to the night's bivouac and the rule is that the cripples must be ready to roll when the brigade marches in the morning. On a march last year the maintenance companies handled eleven major repair jobs in one night putting in 263 man labor hours doing it. At the end of the 700 mile trek the brigade had all but two of its combat cars

Paramount Exhaust Head

and all its other vehicles except one half-track in condition to take part in a strenuous tactical exercise

Thirty five miles is a full day s march for horse cavalry *Fifty miles is a forced march* Returning from a Civil War raid into Pennsylvania Jeb Stuart s Confederate troopers won lasting fame by riding from Chambers burg to White s Ford on the Potomac eighty four miles in twenty four hours—*one of the great cavalry marches of history*

A hundred and fifty miles is a normal day s march for the Mechanized Brigade Marching from Fort Knox to Plattsburg last summer it did 1 000 miles in six days *On one occasion it marched 330 miles in a* little over twenty four hours These marches weren t made under war conditions of course but the iron cavalry moves fast—and it can hit hard when it gets there

The younger soldiers of the Mechanized Brigade have served only in the iron cavalry They were attracted to it through their in terest in automobile mechanics and by the fact that it is something brand new The *brigade has no difficulty in filling its ranks* with high-grade recruits

Nearly all the officers and many of the noncommissioned officers are former horse cavalrymen Some of them I talked with ad *mitted that they missed the horses but all* of them were keenly interested in their new jobs An old top sergeant with a lot of service stripes on his sleeve said When you first come to the Mechanized Brigade *from a horse regiment everything seems* strange to you And then you begin to realize that after all the Mechanized Bri gade isn t so very different from any other cavalry outfit—that you re really doing the same things *for the same reasons only* you re doing them in new ways Cavalry is cavalry whether you re riding a horse or driving a heli buggy

POPULAR SCIENCE Question Bee

THESE are the correct answers to the Question Bee on page 116 Give yourself five points for each one you had right A total score of 75 to 85 is good 90 or better is excellent

1	d	6	No	11	Mole	16	Fauna
2	c	7	No	12	Plane	17	Tackle
3	a	8	Yes	13	Jack	18	Longitude
4	b	9	No	14	Root	19	Strain
5	c	10	Yes	15	Tap	20	Bit



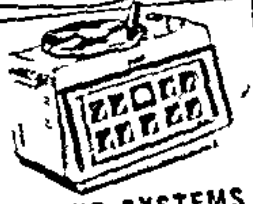
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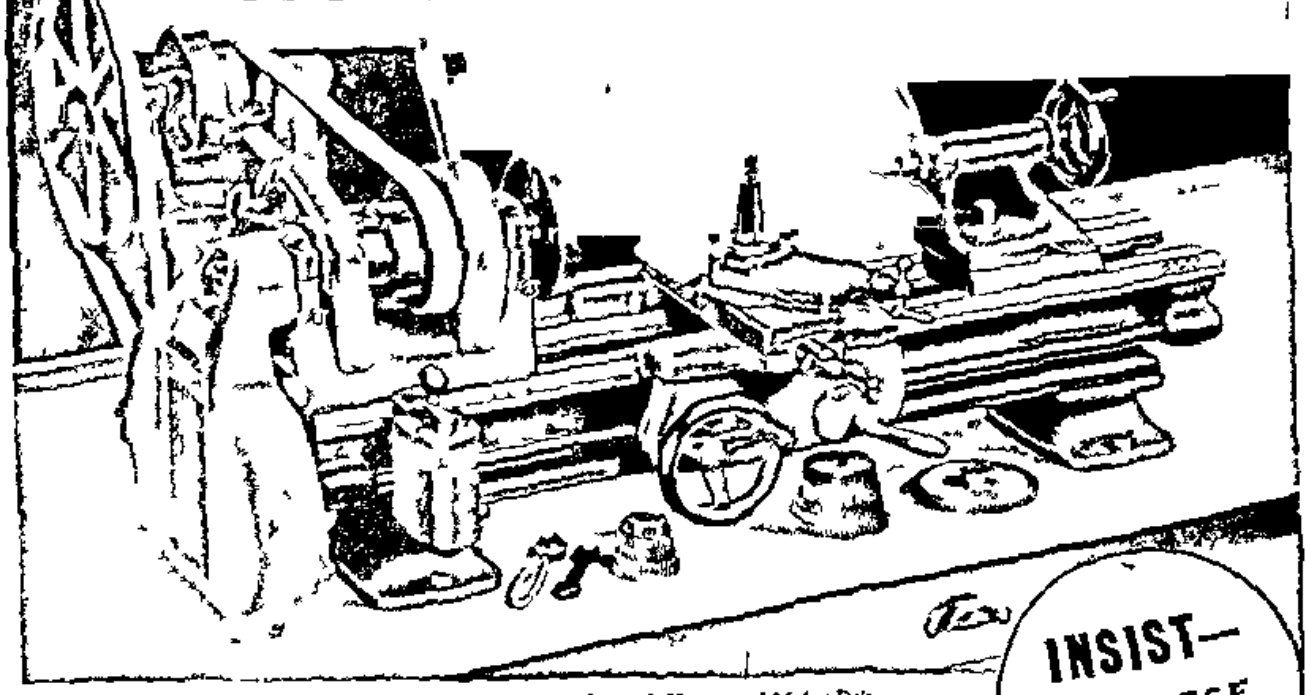
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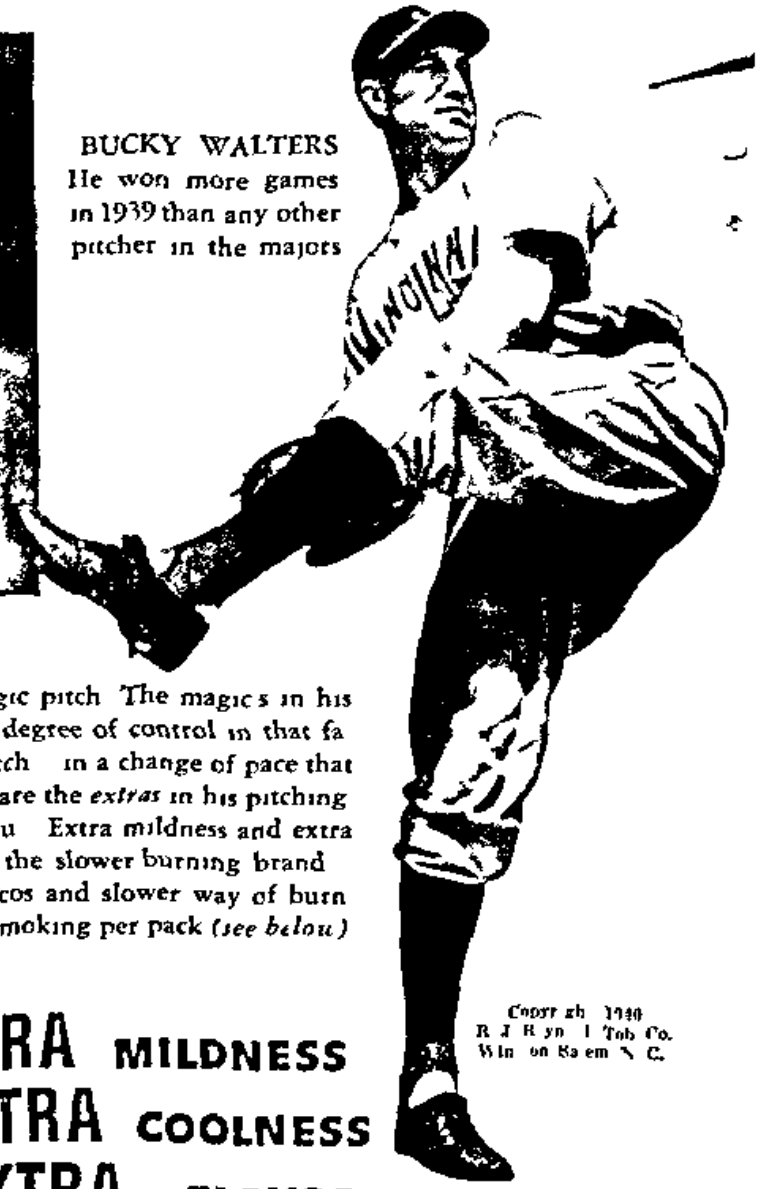
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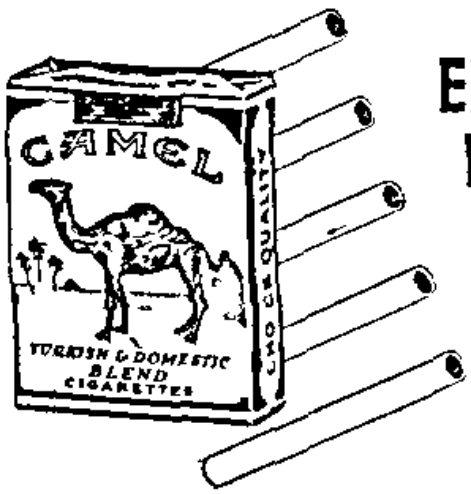
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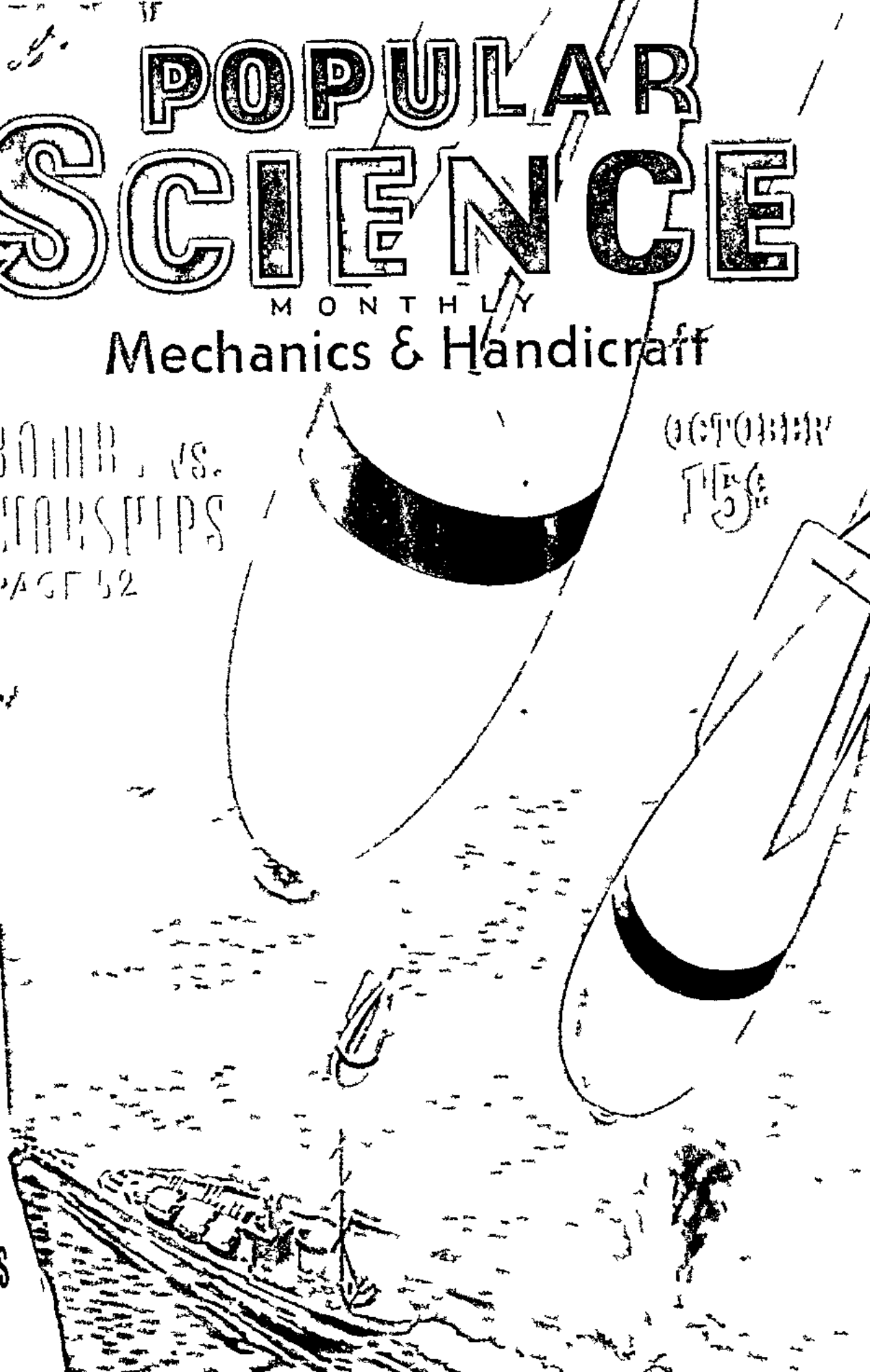
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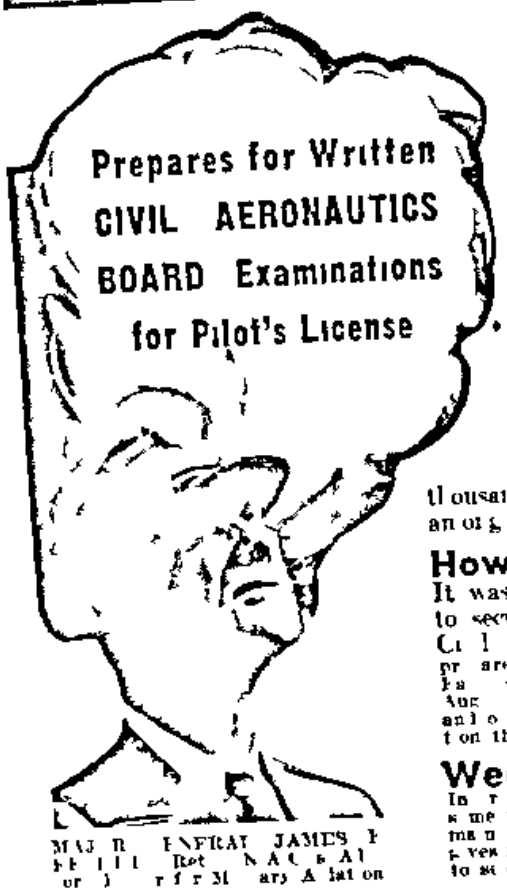
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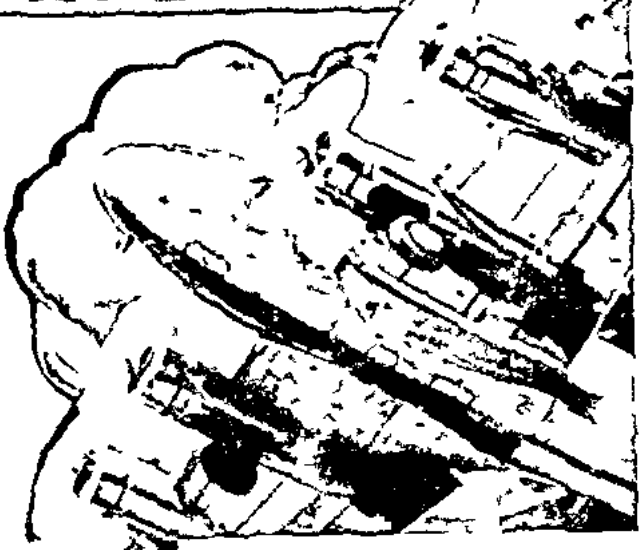
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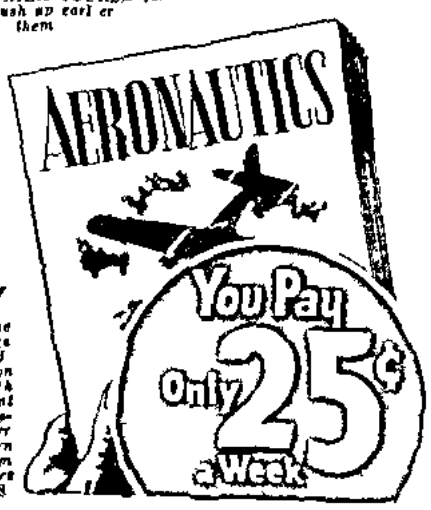
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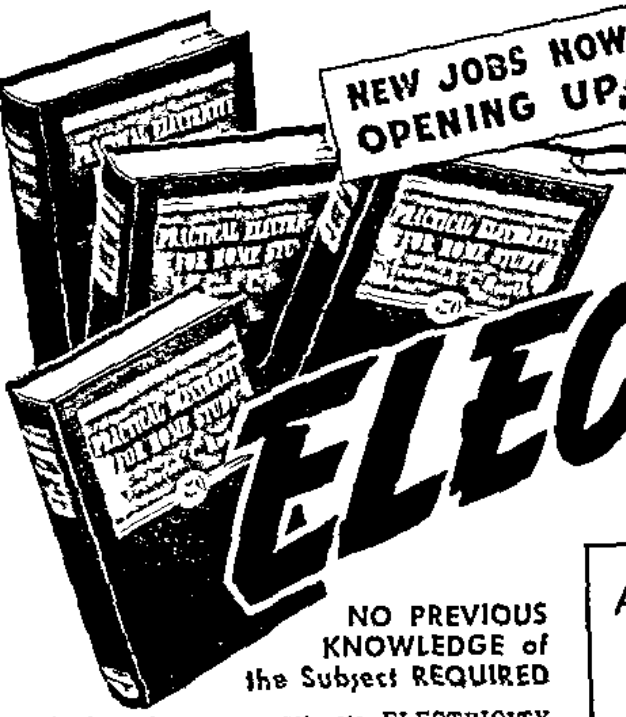
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BOOK 4

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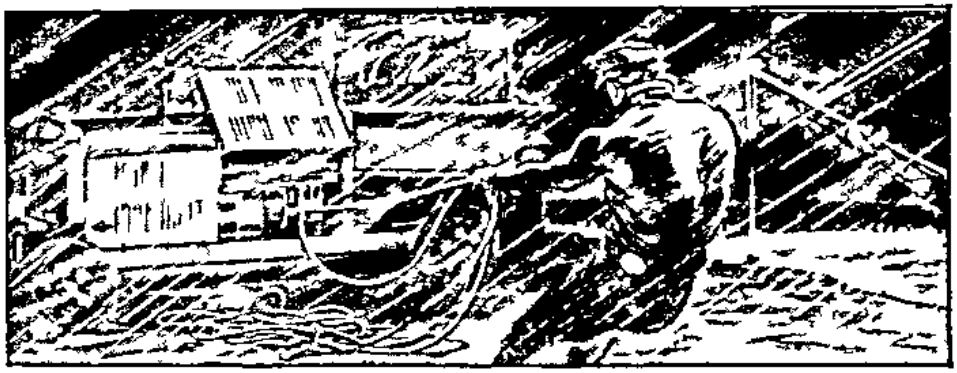


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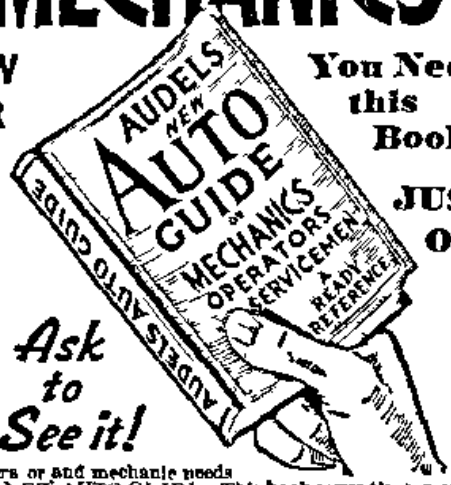
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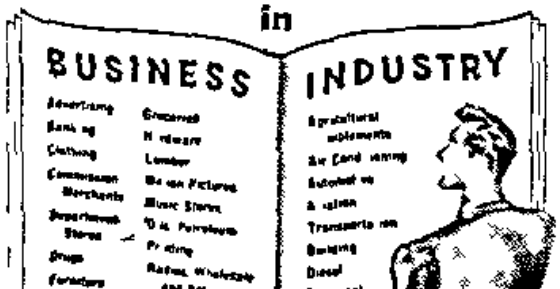
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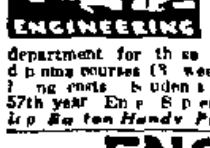
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Broadcasting Stations *employ operators* installation, maintenance men and Radio Technicians in other capacities and pay well.

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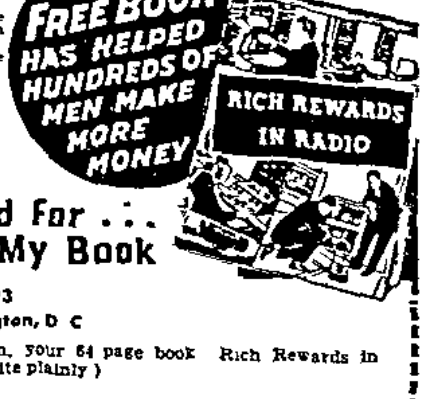
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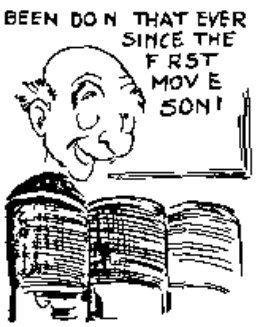
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Our Readers Say



Don't All Speak at Once— Just Raise Your Hands

WHILE attending a movie about a month ago I saw someth ng that I would like your mental wizards to explain It was one of those western films where the stagecoach ran away in the usual manner While I was sit ting there waiting for the hero to catch the runaway a strange sight caught my eye the stage coach wheels were running backward Everything in the picture was moving in the right direction except the wheels I have noticed ever since in western movies that these wheels always run backward Another queer thing is that when the wagon or stagecoach is stopping the wheels suddenly reverse and run in the r ght d rection without any apparent reason I would like some one to explain this phenomenon It bothers me every time I go to the movies—G B Riffle W Va



When a Ship Sinks, It's Sunk, Seems To Be the Answer

IN ANSWER to A. G of New York City I believe a sinking ship goes straight to the bottom Its rate of descent would depend upon how it went down—bow first or other wise As to the ship remaining suspended at a certain depth this is a popular miscon ception Its specific gravity would then have to be exactly one Naval experts have been trying to achieve that in submarines for a long time without success I doubt if it could ever happen by chance—C S North Tarrytown N Y



He Likes the New Arrangement of Our Editorial Pages

IT GIVES me great pleasure to commend you on your new editorial arrangement You also deserve much praise for your constant efforts to improve the magazine and keep it the most valuable magazine on the market, as it has always been in the past—E. B., Paterson N J

He'd Still Keep the Army Mule for Its Educational Value

THIS plan to mechanize our Army is all right with me if the generals think it is the thing to do though we'll surely miss the horses But what about that educational in stitution the army mule? Motor trucks may be able to go faster and haul more but they can't compete with mules in giving men a fluent command of language There's something about associat ing with mules that enlarges the vocabu lary I have heard old time mule skinners who could teach Noah Webster some words he never got in his book You can cuss a motor truck too of course (and some do) but mules seem to bring out everything a man has in him Mech anize all you want but keep a few mules to talk to Otherwise there will be a great decline in the fine art of name-calling—M J Louisville Ky



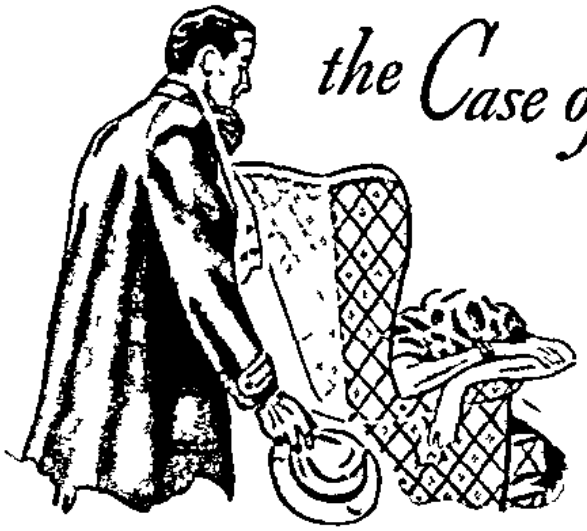
Putting a Speedometer on the Moving Shadow

THE problem of the rate of the moving shadow in the August issue was excellent for brushing up on college calculus The shadow was moving at the rate of four and four forty ninths miles an hour (or approxi mately 4 082) at the required instant—that is if my involved calculations are correct—R G A Brooklyn N Y

Now All We Need Is a Perisphere

WHILE resting my dogs after an all-day tour of the New York World's Fair I want to write a belated letter of appreciation to the editor of my favorite magazine Going through the scientific and industrial displays at the exposition grounds I realized as never before how thoroughly PSM has kept me posted on new developments in all fields of research There was not an exhibit that I saw today which was not made more inter esting and understandable to me by my read ing of your pages I realized that you have been doing in words photographs and draw ings just what the exhibits do In short PSM is a world's fair in itself—and a little

(Continued on page 14)



the Case of the Crying Wife

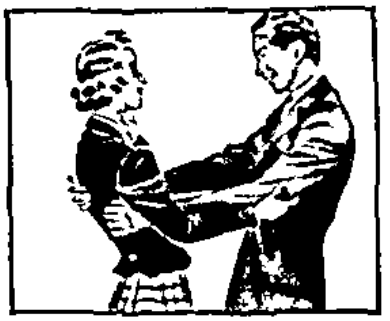
1 Ann doesn t cry easily—but that night I found her in tears! ' I can t help it," she sobbed "All the things we were going to do—buy a car, build a home—remember? And here we are—married three years and just barely making ends meet! I thought our dreams might come true—but it's no use " I made up my mind right then to 'have it out" with the boss



2 "Look here!" he said "I can't *pay* you more unless you're *worth* more! And frankly, John, you lack the *training* a bigger job needs Ever hear of the International Correspondence Schools?"



3 When I learned the boss was a former I C S student, I signed up *quick!* And what a difference it made in my work! I'd never realized until then how *little* I knew about the business



4 I'm happy, and Ann's happy, and I guess the boss is happy. (At least I've had two "raises" in the last year!) And here's the very same coupon that I mailed, staring *you* in the face!

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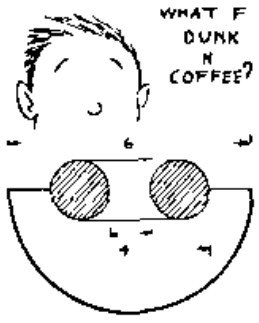
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easier on the feet Why don t you call it A World s Fair in an easy chair ?—T J J., White Plains N Y

Doughnut Dunker's Bad Example Proves To Be a Good Problem

THE math minded boys have been entertaining me for several years through the medium of Our Readers Say so I shall reciprocate by giving them a little food for thought A man was getting ready to dunk a doughnut in his milk He had a hemispherical bowl of six inch diameter containing seven gills of milk and a nice fat doughnut of four-inch outside diameter with a one inch-diameter hole By accident he dropped the doughnut which floated horizontally half submerged in the milk How much milk did the dunker have to mop up off the table? —(Miss) H M S Baltimore Md



Readers Get Together on Siamese Twin Bike

IN YOUR August issue you have a picture of a three-wheeled tandem bicycle made by attaching the front fork of one bike to the rear axle of another This is old stuff I made one with a friend more than three years ago It isn t as rosy as you have it though In the first place you have to ruin some one s front fork by enlarging the holes to go over the axle of the other bike and also it must be spread an unusual amount because of the length of the rear axle Secondly you cannot prevent a torque effect in the middle and the riders must do a hula to keep the bike going All in all it isn t bad especially if *your* bike is used for the load.—H. M., Jamestown N Y



WITH my cousin I have used this method of cycling for some time and heartily recommend it for long-distance travel By tuning our bicycles up we are able to reach speeds approaching fifty miles an hour a speed of twenty miles an hour can be held for some distance without tiring the riders There are however certain difficulties encountered in this arrangement In starting until practice has been had an unpleasant swinging is given to the rear man sometimes enough to throw him off On corners the rear man should stop pedaling and give all his attention to balancing The sharpest turn possible is about a ten foot circle and the bicycles will lock in the turn unless the front man has strong wrists and arms On sharp turns the rear bicycle leans the wrong way I have been thrown at least twenty times when turning around in the middle of a street In spite of these difficulties however the ease of travel for distances or hill climb amply repays the riders—W G Winnipeg Canada

Whatever Became of the Nicaragua Canal?

THAT was an interesting and timely article on Enlarging the Panama Canal Certainly our Big Ditch needs every possible protection But why not put through a second canal in Nicaragua? As I remember it the Nicaragua site was considered long before the U S took over the French project at Panama In 1888 I believe a survey of the Nicaragua route was made by a party of U S Navy engineers under R E Peary later discoverer of the North Pole Their report was so favorable that the canal was nearly built there in the first place More recent surveys by Army engineers have confirmed the feasibleness of the plan. With two entirely separate canals it would be some job for an enemy to bottle up our fleet in one ocean There is another advantage in this plan with two separate canals there would be two different sea approaches That would make it harder for an enemy to cut off our naval and merchant ships by mines or blockade—E S T, Washington D C



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(Continued on page 16)

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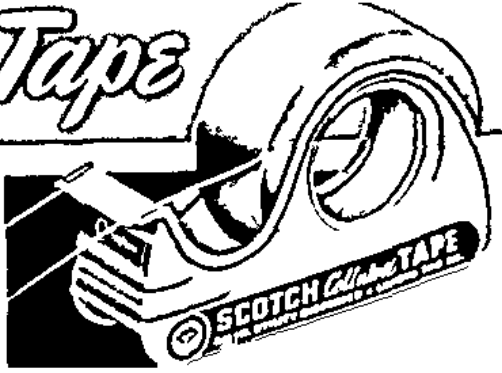


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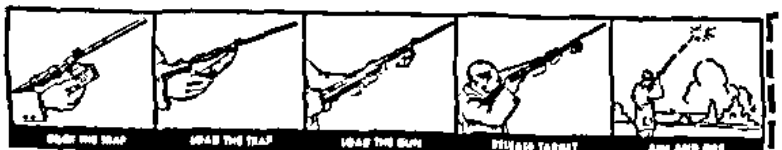
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My wife was stricken with blindness last October and we were compelled to go away for medical treatment Now we have returned home so she may recuperate and slowly regain her eyesight happy in knowing that medical science and surgery have saved her from blindness But we have not missed an issue of Popular Science You see women like Popular Science as much as men so I read each issue to her The effect on her mental condition in aiding recovery of vision was worth the magazine s weight in gold to us Which leads me to tell you that your staff little realize as you send Popular Science on its way throughout the world the great amount of happiness and contentment it carries into homes The reading of its pages to my wife brought a change and contentment to her when life seemed darkest and those printed words helped greatly in leading to her recovery Our doctors when told of the comfort she received from hearing it read to her said Don t miss an issue Read it to her It s as good as our medicine now because she needs rest and quiet nerves It will greatly help her on the road to recovery So I am deeply indebted to you your staff and the most welcome magazine.—R. R R., Bitely Mich



Why Not Use a Catalyst as a Diesel Spark Plug?

This is a question from a layman who maybe ought to know the answer but doesn t Why can t designers and manufacturers of Diesel engines take a cue from the acetylene welder who lights his torch with a minute piece of platinum? Is there no way in which a catalyst could be used in the combustion chamber of a Diesel engine? If Diesel-engine fuel is a hydrocarbon and if acetylene is a related substance what reason is there that a catalyst related to platinum cannot be used in order to make the Diesel engine of lower compression and therefore lighter simpler and cheaper in construction? I would like to see this question answered but maybe I wouldn t understand it—J V R Salt Lake City Utah

You Can't Blame the Inventors for Human Cussedness

There was an ironic note in your With the Inventors last month In the first item you listed the airplane as one of the great American inventions Then just below that you described a plan to make houses disappear into the earth to escape bombers What if the Wright Brothers could have foreseen the use that mankind would make of their invention? Although the airplane is the most striking example almost every invention you can name has been prostituted to the purposes of destruction An inventor never knows whether he is making life better for humanity or helping the race kill itself off—D M Boston Mass

Does Friction Upset Electrical Balance of Conductors, Too?

One of your readers asked why a static electrical charge appeared on glass and other nonconducting materials when rubbed I wonder if it could not be that such charges also appear on metal but the metal being a conductor dissipates them? It seems to me that most any substance is capable of having some of the electrical balance destroyed by friction—R S Pasadena Calif



It's All Right If You Don't Puncture Your Maps

Take a rubber balloon with writing on it or draw something on a plain one Blow it up The writing or the drawing is enlarged. Well why not make maps plans and other things on sheet rubber? The sheets could have corner pieces with holes for thumb tacks Then all you d have to do is stretch out the sheets tack them down and draw on the surface Stretched to the same tension they could be used any time Take out the tacks and your plans shrink for easier filing carrying and so forth You can fold them crumble them in your hand drop em in the lake but you can t hurt your plans Will some one let me know if it works? I never tried it—D W Whippany N J



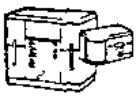
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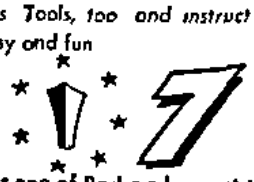
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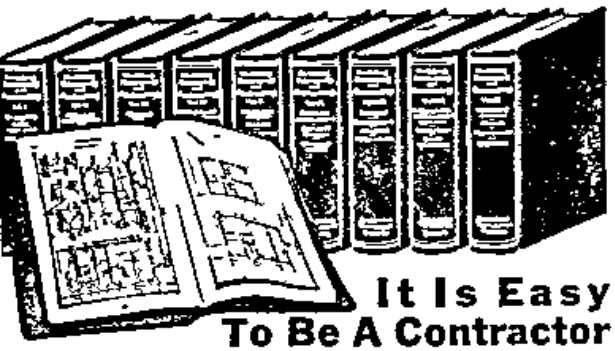
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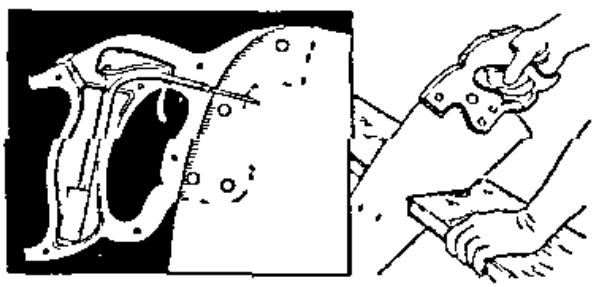
WITH Halloween just around the corner an odd false face developed by George L. Edwards of Fuquay Springs, N C, should prove of interest to thousands of prospective revelers Made of thin rubberized material, the comic mask is provided



with air pockets or pouches at the nose, cheeks and ears into which air can be blown by an inflating tube held in the mouth of the mask wearer Thus the ears nose, or cheeks of the mask can be puffed up into ludicrous forms that change their shape as the mask wearer inflates or deflates the pouches The false face is attached to the head by means of head straps, and also by loops that are stretched around the ears . . . TWENTY SIX consecutive patents were recently granted on the same day to one inventor Sidney Musher, of New York City Practically all of them relate to methods of stabilizing various foods or food compounds . WALTER KREBS, of Jamaica, N Y, is credited with the design of the handy beverage mixer shown in the illustration powered by two dry cells contained in a flashlight battery case, the unit has mixing blades mounted at the end of a shaft designed to go down into a tall drinking glass A handle attached to the battery case of the diminutive mixer makes it easy to hold the unit upright while it is in use . . . CONGRESS has passed and the President has signed a bill authorizing the Commissioner of Patents to keep secret all patents relating to national defense The legislation also gives the U S Army and Navy immediate access to all war inventions on which patents are now pending or on which patent applications will be made . . .



BECAUSE he recognized that the ordinary smoker's pipe is an awkward object to carry in a pocket, and because he felt that the average smoker likes variety in the shape of his pipes Robert S Blair, of Stamford Conn, worked out a novel pipe that has a flexible stem Made of strips of metal twisted spirally into tubular shape, the stem can be bent back so that the mouthpiece is over the bowl, thus forming a compact unit that is easy to carry The stem may also be twisted to any desired shape to give the smoker a straight or curved stem pipe Within the stem tubing a flexible condenser device consisting of bristles fastened to a twisted wire center, filters the smoke as it passes through . THE FIRST REAL MONEY that Edison ever made as an inventor came not from any outstanding or basic invention, but from a simple improvement in a telegraphic instrument OIL IS SPRAYED onto the blade of a handsaw to lubricate its teeth while in use, by means of a novel device that is the joint



invention of Albert Pihlquist and Arvid Larson of East Hempstead N Y From a small oil reservoir built into the wooden saw handle a discharge tube leads to nozzles

(Continued on page 22)

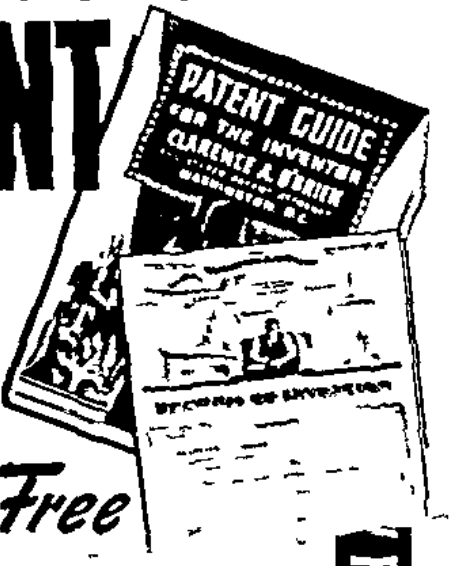
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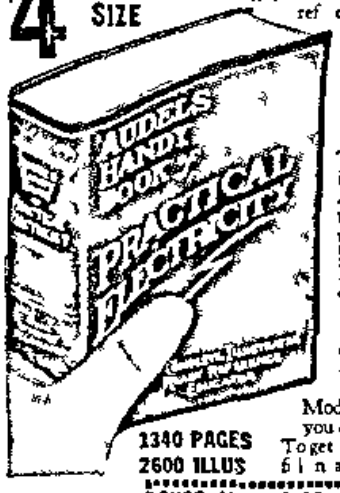
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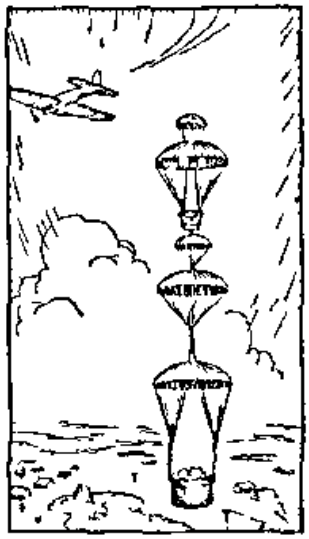
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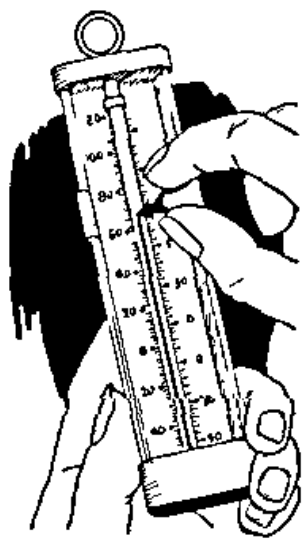
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With the Inventors

(Continued from page 22)

mounts from step to step As illustrated one foot will use the regular stair treads and the other the auxiliaries TO MAKE IT POSSIBLE to parachute heavy loads such as weapons ammunition, and other military supplies from airplanes to forces on the ground Francis McCarroll a Lakehurst N J inventor, suggests tandem parachutes This arrangement, he claims would float heavy objects to earth slowly and with little chance of the load oscillating or swinging back and forth as it descends and hits the ground In his invention the load to be dropped would be stowed in a bag or basket attached to a series of three or more main chutes which would open out one after the other from a container in which they are packed The container would be attached to several pilot chutes whose chief function would be to open the main load bearing parachutes FOR NOTING CHANGES in temperature or as a guide in maintaining a desired amount of heat or cold in temperature - controlled rooms a thermometer invented by Stanton L. Lane of Fuquay Springs N C is equipped with a sliding pointer Set at any level it shows at a glance whether the temperature is above or below that point. Since the pointer is colored to match the liquid in the thermometer tube it is easy to read it at a distance MORE PLANT PATENTS are held by Dr Ralph H McKee of New York City than by any other individual His total of patents in this classification is fourteen, all for hybrid poplar trees





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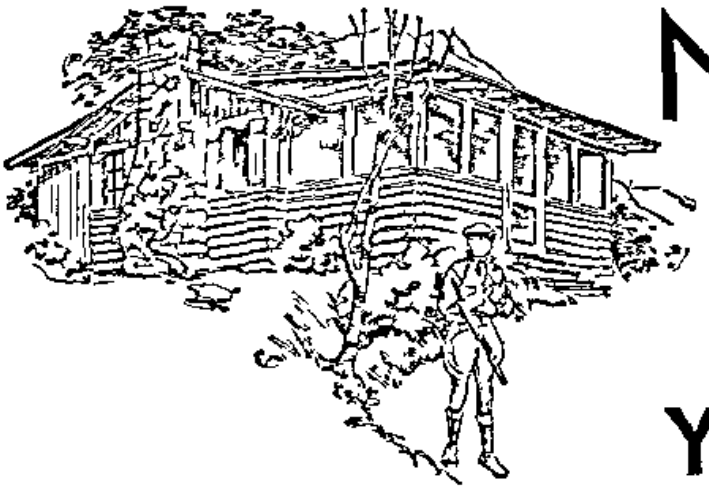
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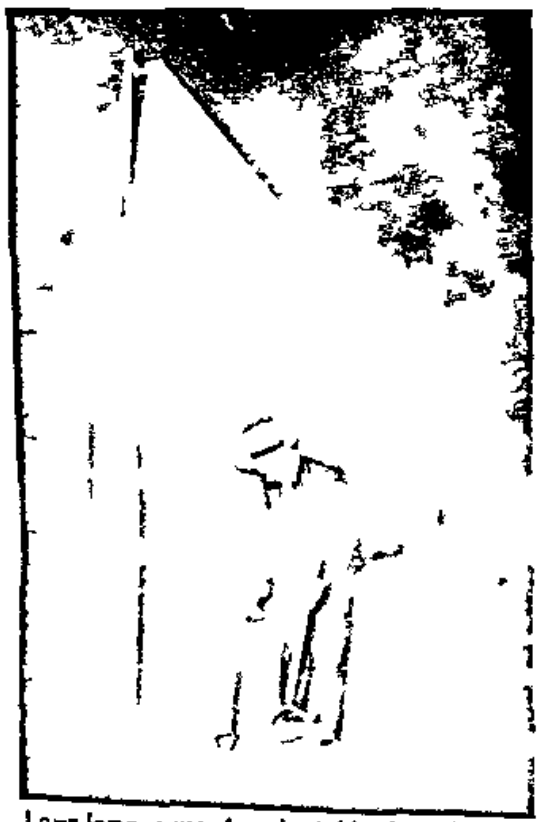
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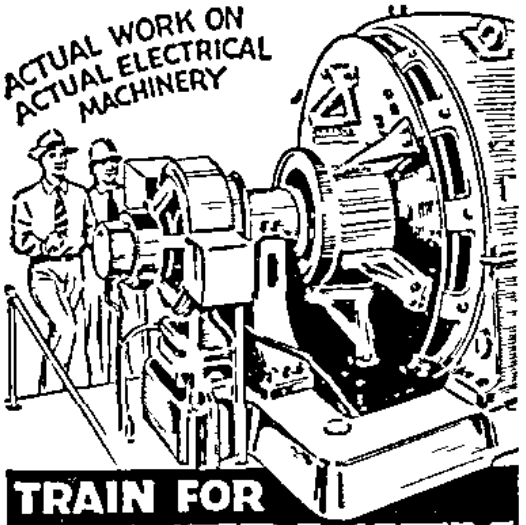
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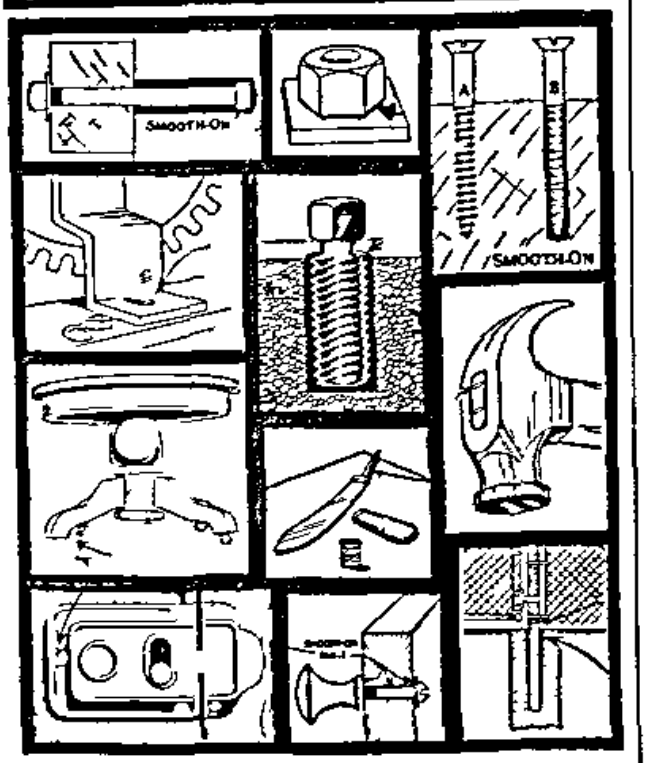
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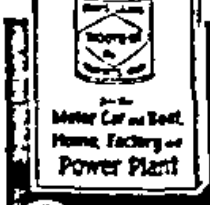
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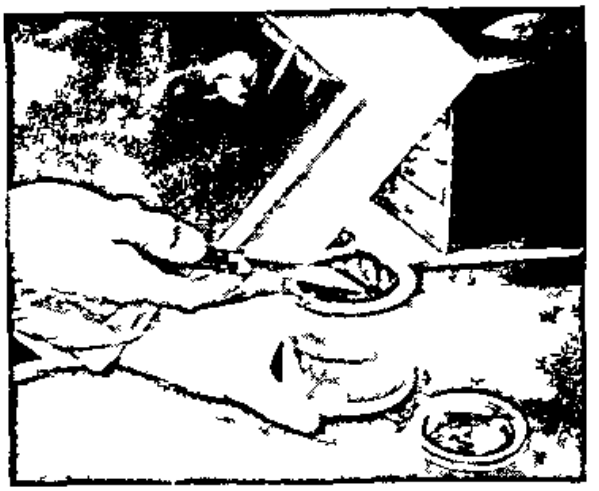
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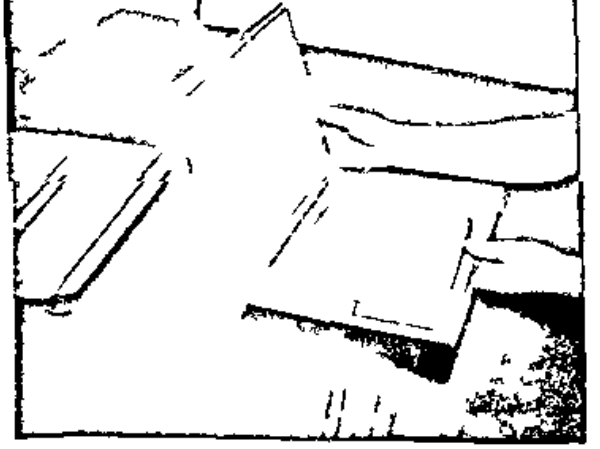


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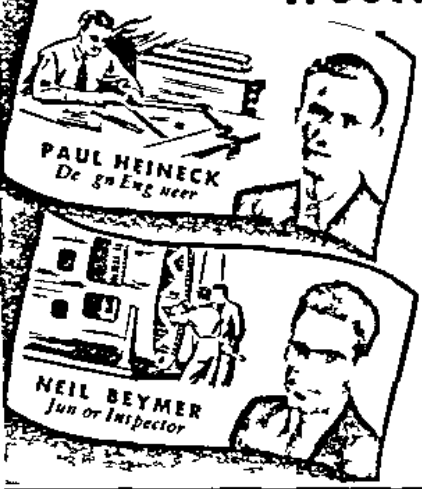
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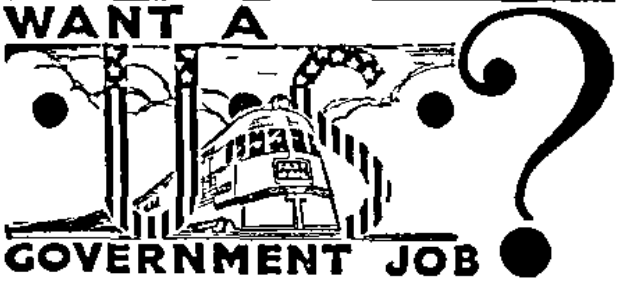
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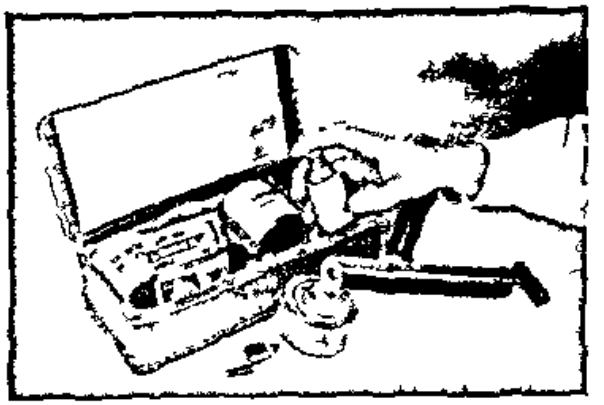
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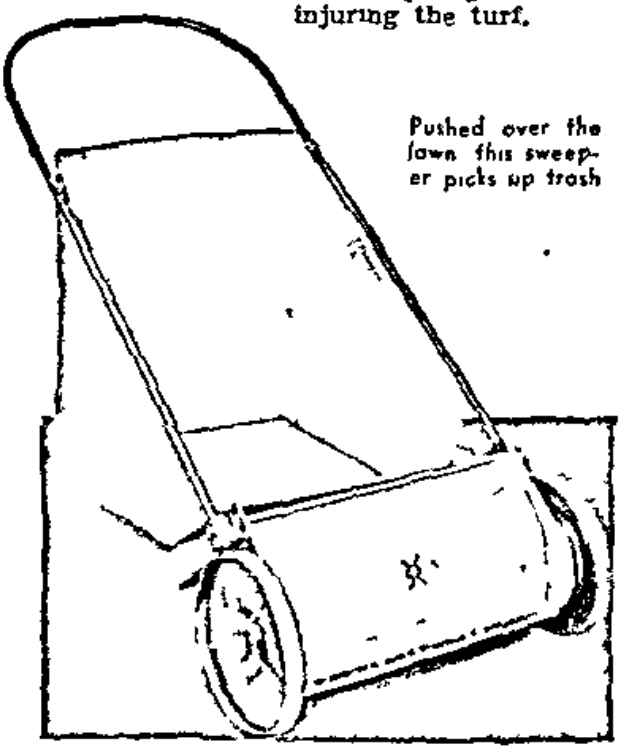


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Sweeper Cleans Lawns

PAPER leaves sticks stones freshly cut grass, and other debris is easily removed from lawns by the two-wheeled sweeper pictured below Operated like a lawn mower, the machine sweeps up debris into a canvas collecting bag without injuring the turf.



Pushed over the lawn this sweeper picks up trash

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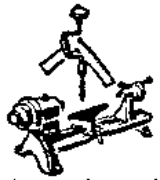
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A strange man in Los Angeles known as "The *Voice of Two Worlds*' reveals the story of a remarkable system that often leads to almost unbelievable improvement in power of mind, achievement of brilliant business and professional success and new happiness Many report improvement in health Others tell of increased bodily strength magnetic personality, courage and poise

The man, a well-known explorer and geographer tells how he found these strange methods in far-off and mysterious Tibet, often called the land of miracles by the few travelers permitted to visit it He discloses how he learned rare wisdom and long hidden practices closely guarded for three thousand years by the sages, which enabled many to perform amazing feats He maintains that these immense powers are latent in all of us, and that methods for using them are *now simplified* so that they can be used by almost any person with ordinary intelligence

He maintains that man, instead of being limited by a *one-man power-mind*, has within him the mind-power of a thousand men or more as well as the energy-power of the universe which can be used in his daily affairs He states that this sleeping giant of mind-power, when awakened can make man capable of surprising accomplishments from the prolonging of youth to success in many fields To that eternal question, 'Do we have to die?' his answer is astounding

The author states the time has come for this long hidden system to be disclosed to the Western world and offers to send his amazing 9000-word treatise—which reveals many startling results—to sincere readers of this publication, free of cost or obligation For your *free copy*, address the Institute of Mentalphysics 213 South Hobart Blvd, Dept 72M, Los Angeles, California Readers are urged to write promptly, as only a limited number of the free treatises have been printed



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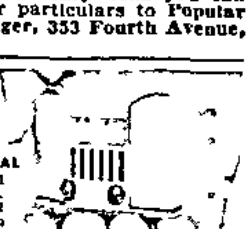
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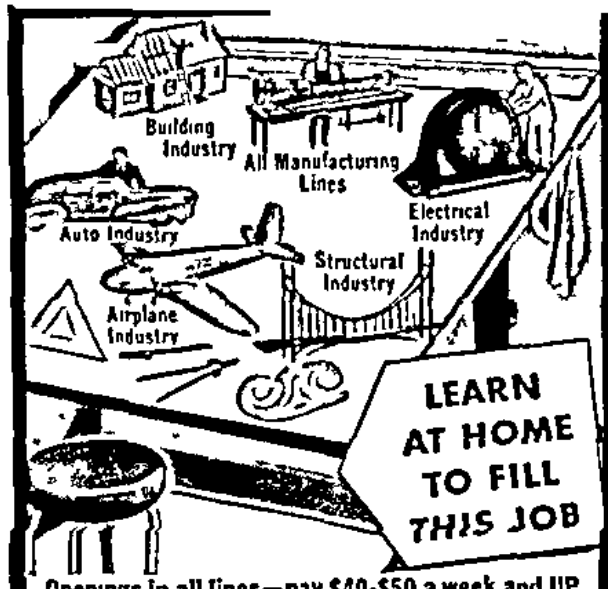
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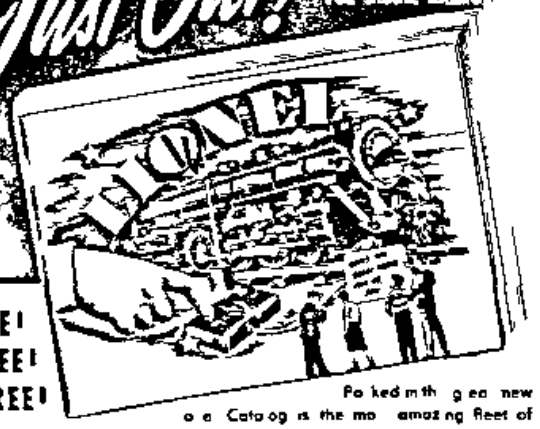
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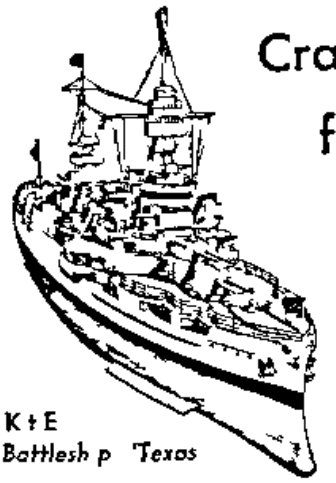
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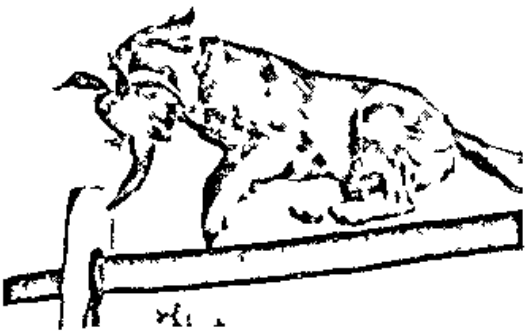
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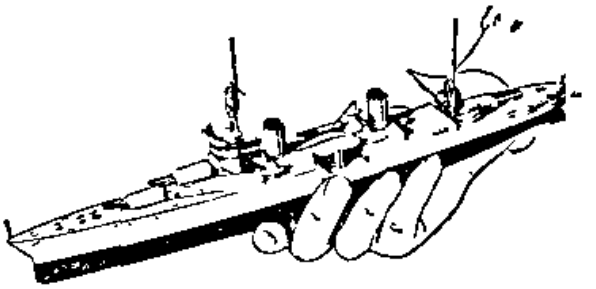
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(Continued from page 36)



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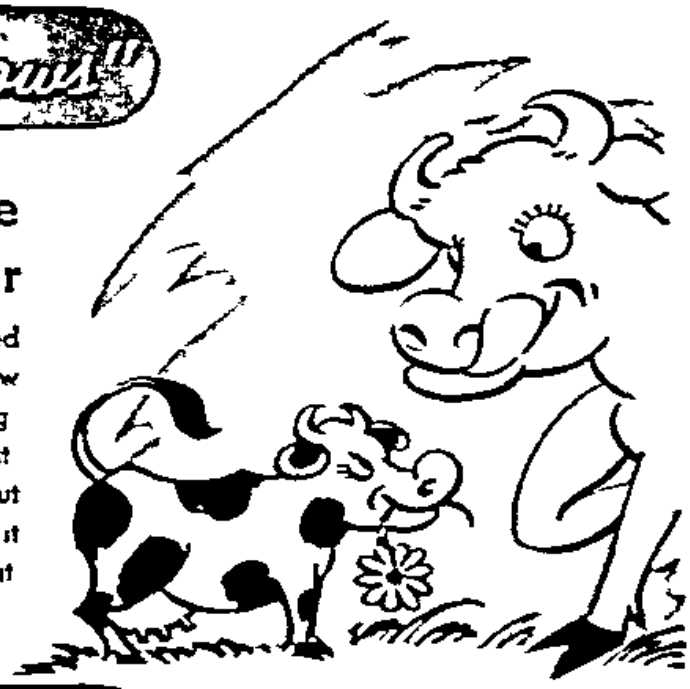


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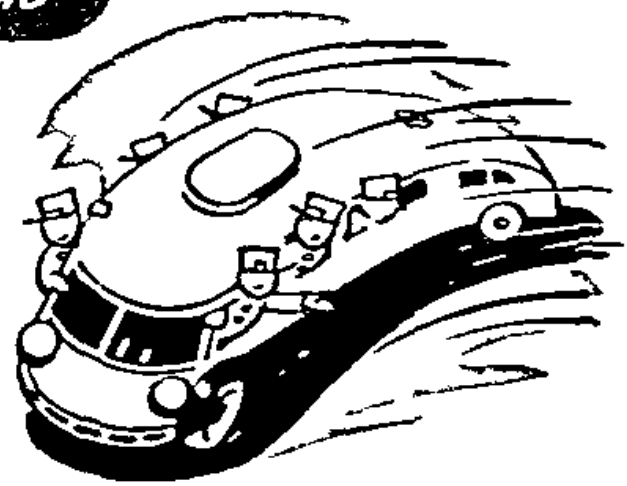
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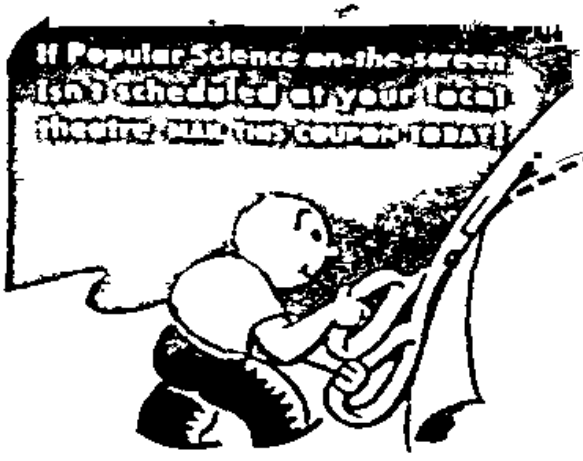


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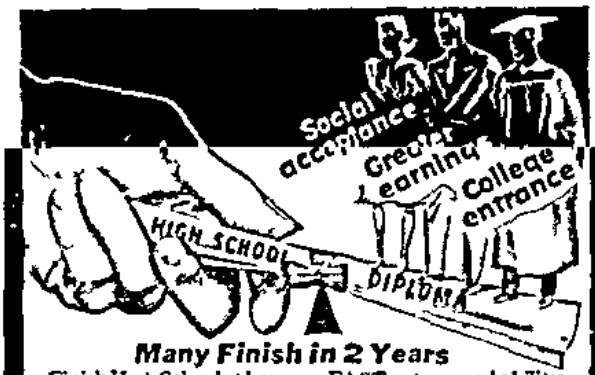
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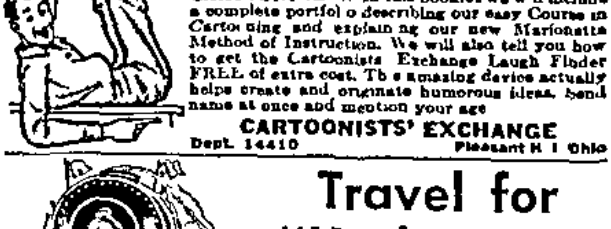
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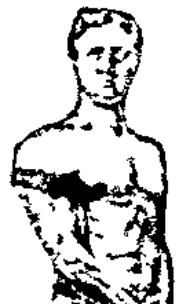
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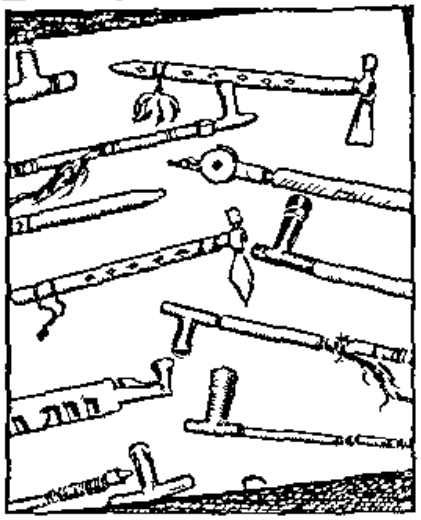
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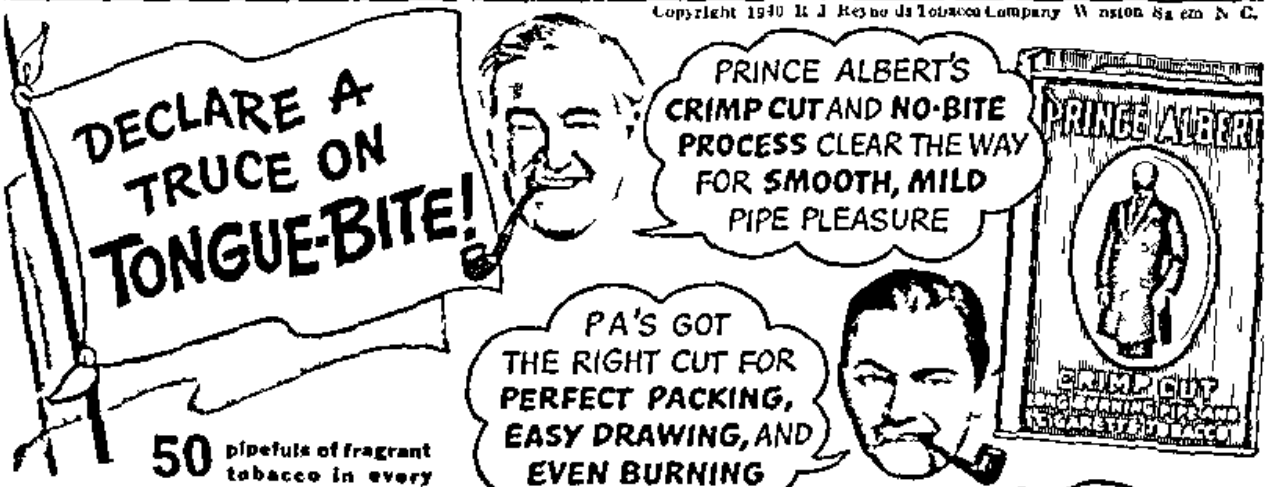




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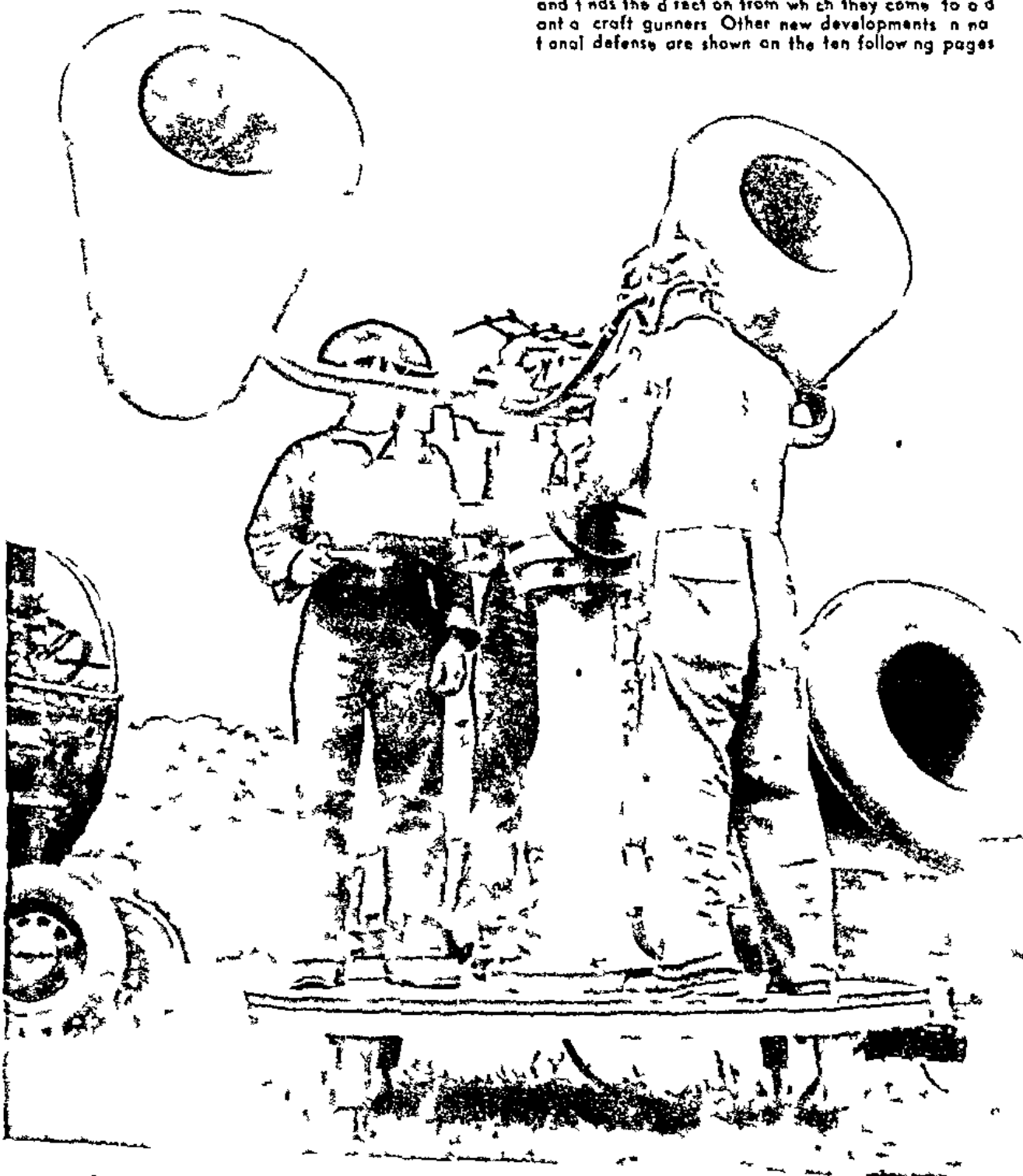


PRINCE ALBERT
THE NATIONAL JOY SMOKE

POPULAR SCIENCE Monthly

NEW EARS LISTEN FOR ENEMY PLANES

A new type sound detector for locat ng approach ng a c oft be ng tested by the U S Army at recent maneuvers L ke other dev ces of ts k nd t p cks up fa nt v brat ons f om plane motors and p opelle s and f nds the d rect on from wh ch they come to a d ant a craft gunners Other new developments n na t onal defense are shown on the ten follow ng pages



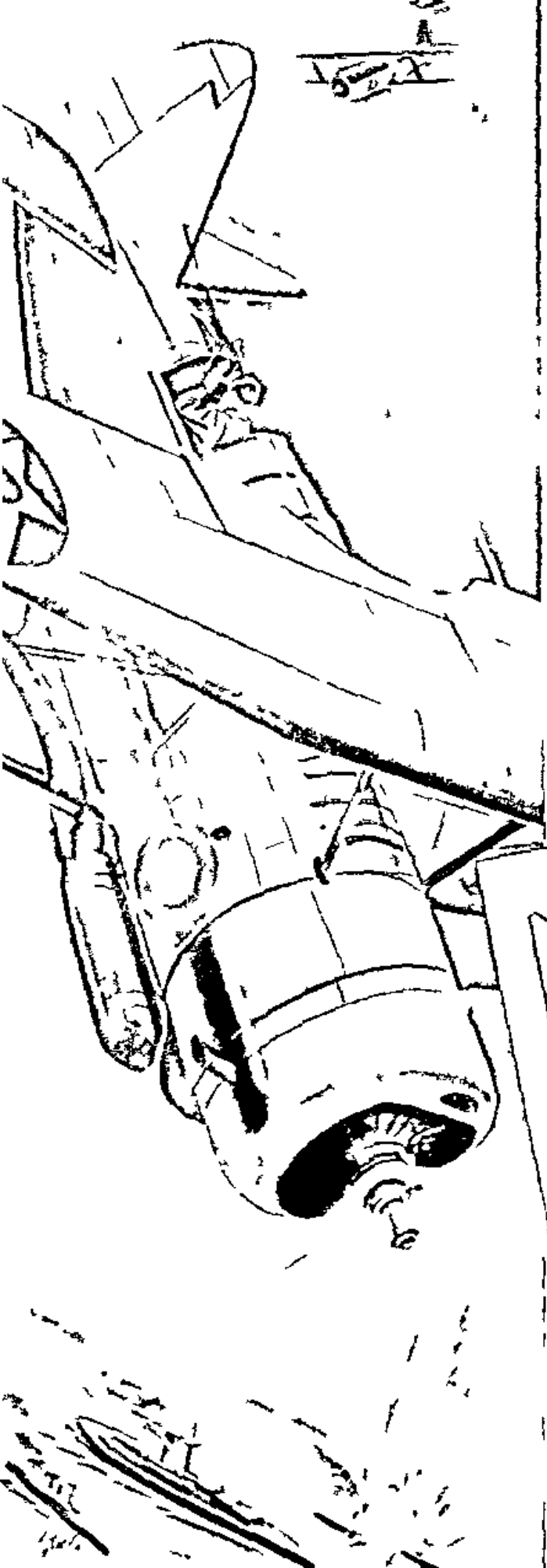
Bombers

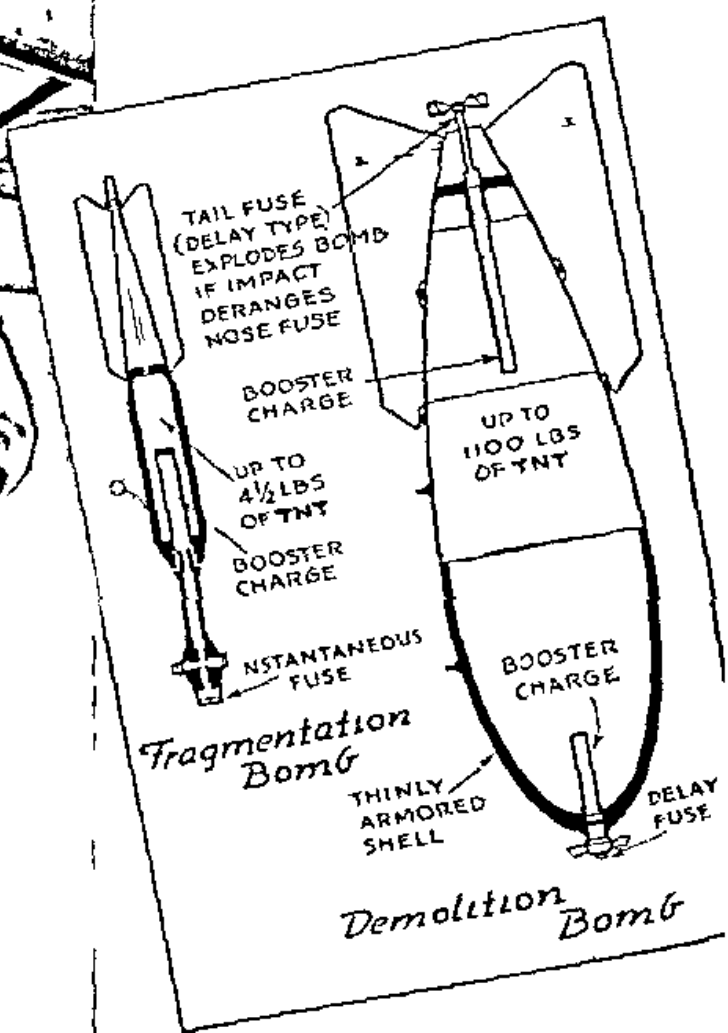
HOW NAVAL EXPERTS

WITH waves of swift bombing planes casting their winged shadows over seas long ruled by battleships modern air power is offering a new threat to naval supremacy Meanwhile we find ourselves embarked on an unprecedented program of warcraft construction and the question of how effectively our latest ships can meet this menace from the skies renews a long standing controversy between advocates of air forces and sea forces

Here is a composite answer as given by Admiral Harold R. Stark Chief of Naval Operations Rear Admiral A B Cook head of the Navy's Bureau of Aeronautics and other top flight Army and Navy officers who ought to know, if anyone does just what planes and ships can do to each other

Three types of aircraft menace war-





or Battleships?

ANSWER A VITAL QUESTION ON DEFENSE

ships each in a specialized way—horizontal bombers dive bombers and torpedo planes And each has its advantages and drawbacks

Horizontal bombers attack their targets *from relatively high altitudes aiming their* missiles with a precision bomb sight The size of these large multiple engine craft gives them great cruising radius and bomb carrying capacity Flying miles high makes them comparatively safe from a warship s antiaircraft fire

But all is not on the side of the bomber s crew by any means For safety in altitude they pay in loss of bombing accuracy Viewed from 5 000 or 10 000 feet even the biggest warship makes a pretty small gray speck upon the blue ocean If they descend to improve their chances of hitting it their *own chances of getting hit by its five-inch* antiaircraft guns rise in exactly the same proportion

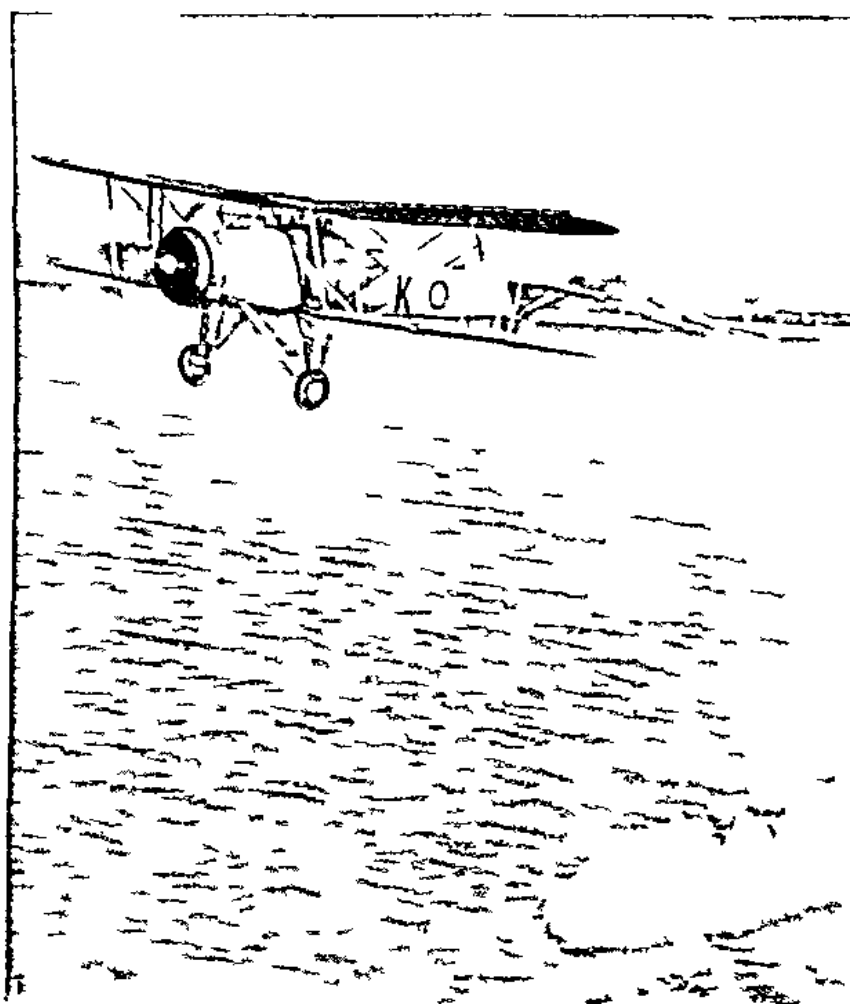
And here is a little known fact. More than half the time clouds over the ocean prohibit bombing from above 10 000 feet. For days on end unfavor able weather may keep the ceiling much lower

Even worse a horizontal bomber suffers from one incurable weakness owing to its method of bomb sight ing Just before dropping a bomb *for a period variously* estimated from fifteen sec onds to more than a minute it must maintain an abso lutely fixed course and speed This delights antiaircraft gunners

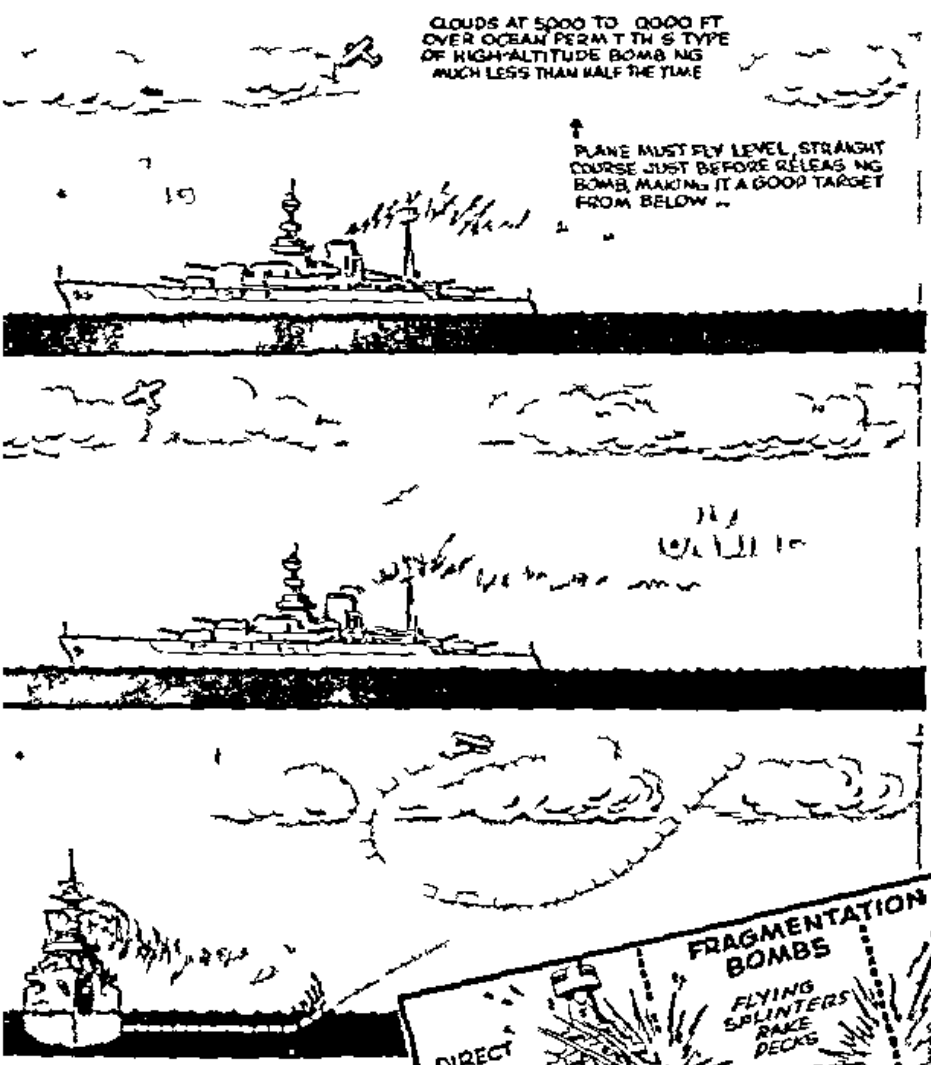
Dive bombers use entirely different tac tics Power diving almost vertically upon *their target at more than 400 miles an hour* they release bombs at such low altitudes that the projectiles can scarcely miss In this type of bombing there need be no elaborate corrections for altitude wind and the speed and direction of the target Only the simplest sort of sight need be used the *pilot virtually aims the bomb by aiming* the plane A favorite stratagem is to dive out of the sun so that its glare blinds gun ners below

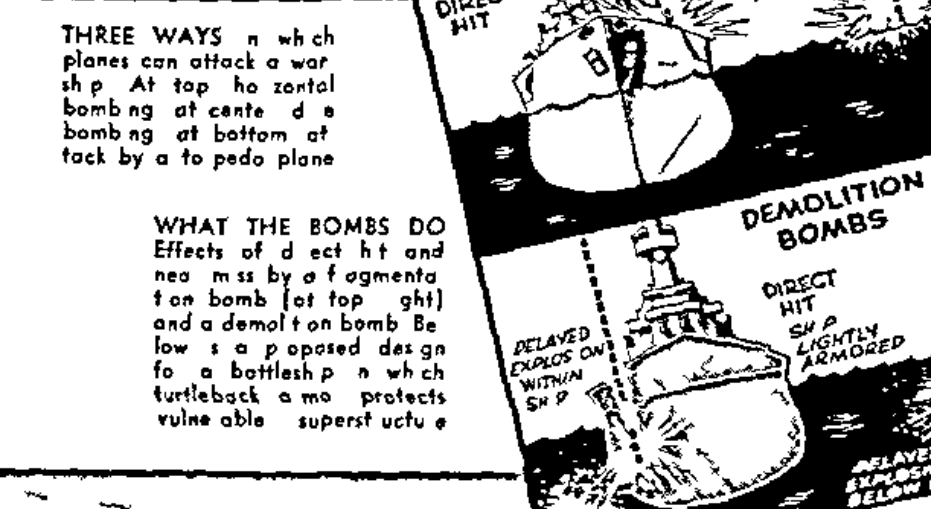
But the dive bombers very style of at tack means flying down the barrels of all the antiaircraft ordnance that can be *trained upon them They run the gantlet* not only of the big hand loaded guns but also of the shorter range multiple pom poms or machine cannon that throw a continuous hail of small explosive shells much as a machine gun fires bullets Then

By
ALDEN P.
ARMAGNAC



Draw ng shows the two princ pal types of bombs used aga nst war-sh ps Fragmentat on bomb (at left) shatters nto p eces that wreak havoc among exposed per sonnel demol t on bomb s de s gned for structural damage to sh p In photo at r ght a low fly ng plane drops a torpedo





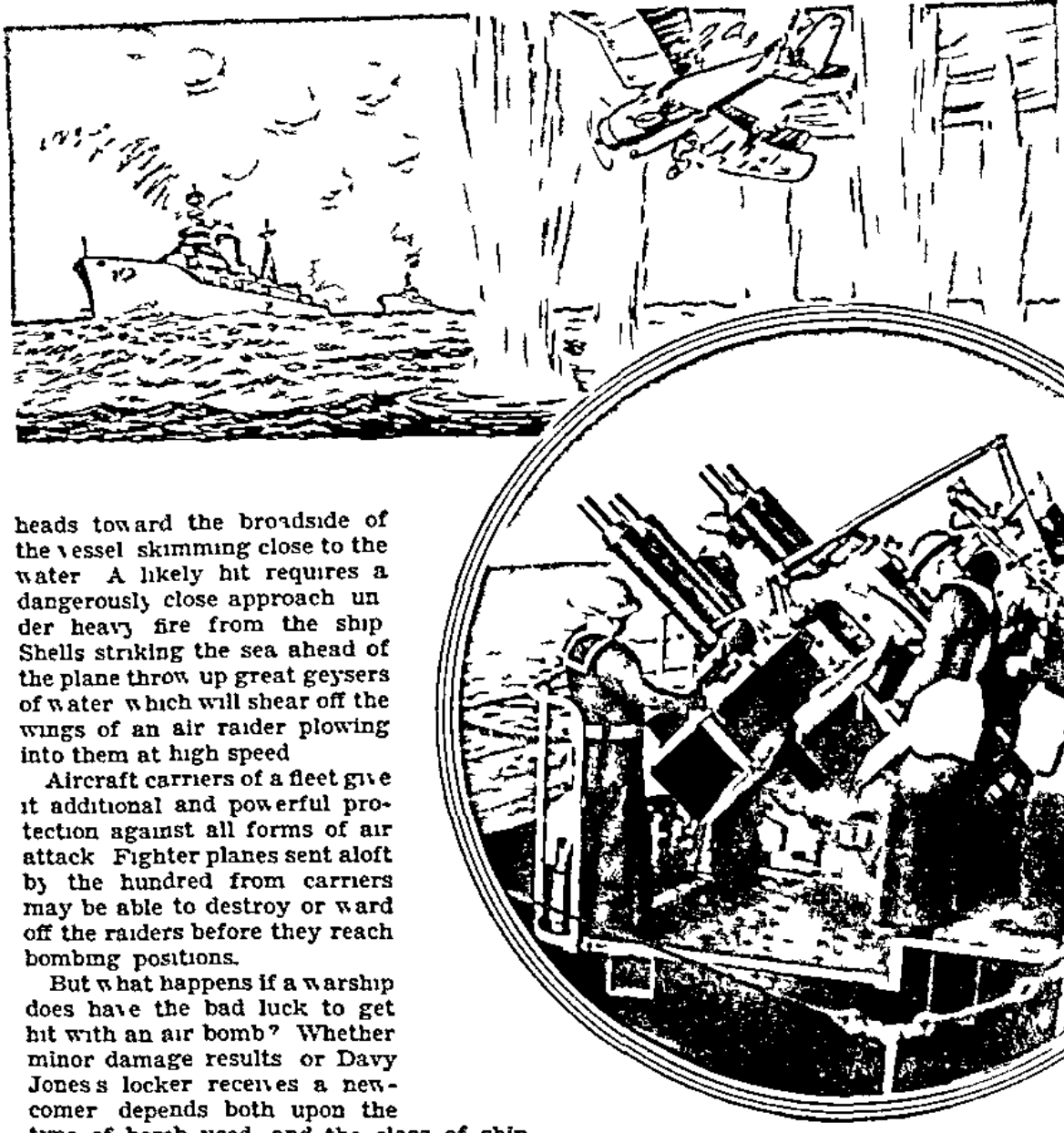


THREE WAYS in which planes can attack a warship. At top horizontal bombing at center dive bombing at bottom attack by a torpedo plane

WHAT THE BOMBS DO. Effects of direct hit and near miss by a fragmentation bomb (at top right) and a demolition bomb. Below is a proposed design for a battleship in which turtleback armor protects vulnerable superstructure

too the terrific strain of pulling the planes out of their fast dives requires bombers of this type to be small machines. Because of their diminutive size their capacity to carry bombs is limited. Likewise their curtailed weight of fuel tethers them within a short range of their base. An admiral who gives a respectfully wide berth to a beehive of shore based dive bombers need have little fear for his ships.

There remains the torpedo plane. To launch the torpedo slung beneath its fuselage it



A multiple pom pom in action. Above geysers of water from shell fire wreck a torpedo plane

heads toward the broadside of the vessel skimming close to the water A likely hit requires a dangerously close approach under heavy fire from the ship Shells striking the sea ahead of the plane throw up great geysers of water which will shear off the wings of an air raider plowing into them at high speed

Aircraft carriers of a fleet give it additional and powerful protection against all forms of air attack Fighter planes sent aloft by the hundred from carriers may be able to destroy or ward off the raiders before they reach bombing positions.

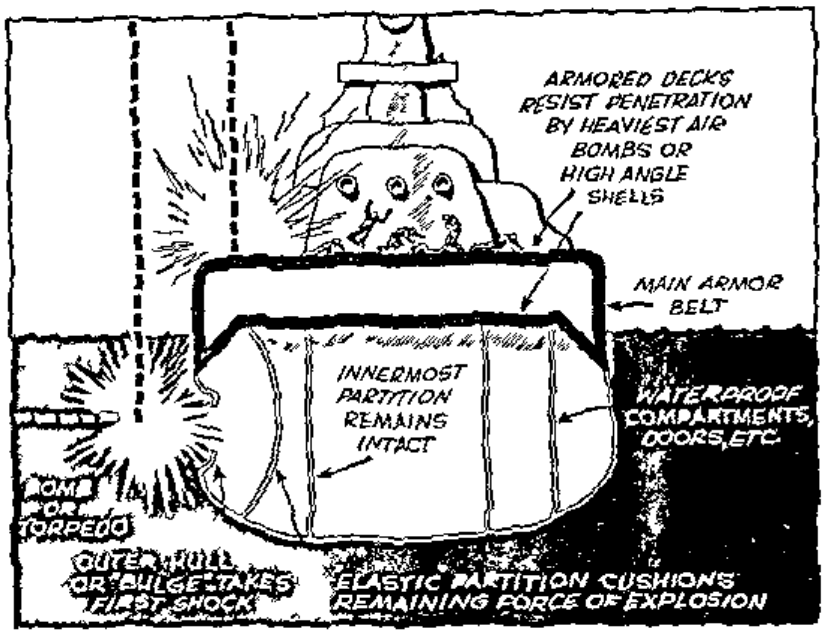
But what happens if a warship does have the bad luck to get hit with an air bomb? Whether minor damage results or Davy Jones s locker receives a newcomer depends both upon the type of bomb used and the class of ship

Fragmentation bombs inflict casualties among exposed personnel Fused to explode instantaneously they hurl deadly fragments of steel in all directions If they miss a ship and hit the water near by they still detonate in time to rake the deck with their splinters. Because of their light weight—thirty pounds or less—airplanes can carry large quantities of them For the same reason they effect little or no structural damage upon a ship

Demolition bombs on the contrary, are all that the name implies They range in weight from fifty to 2 000 pounds Often they are fitted with delay action fuses so that they burst after penetrating the target or the surface of the water So adapted a bomb of this type acts in the same way as a depth charge to destroy a thin skinned submarine Spotted from the air while it is submerged, an undersea craft is helpless to fire back or, because of its limited speed to maneuver to dodge bombs At the surface, it is almost as vulnerable In fact, reports indicate that air bombers are almost as effective antisubmarine weapons as the sub chasers of the last war

Destroyers and other small warcraft, too, can be sent to the bottom by a direct hit from a heavy demolition bomb Their protection lies in their limited size as targets and their ability to throw off a bomber s aim by fast, zigzag maneuvering

Bigger ships though better targets have more in their favor Even an amateur mathematician will realize that, when you add



Mass ve deck and side armor guards the battleship s vital parts from harm

to a ship s size the deck area increases only as the *square* while the *displacement—and* therefore the weight of armor that can be carried—increases as the cube This explains why great battleships can be armored far more effectively than smaller craft *against air bombs*

Massive horizontal decks of armor plate placed as near as possible to the water line to conserve stability supplement the 'belt' or side armor of modern capital ships Originally intended to protect the magazine and other vital parts deep in the hull from high-angle shellfire this deck armor now serves the added purpose of warding off air bombs In the newly launched 35 000 ton U S battleships *Washington* and *North Carolina*, it is reported to attain the extraordinary total thickness of *ten inches* Even a *2 000 pound* demolition bomb formidable as it sounds, shatters against such armor like an egg dropped on a *concrete pavement.*

Special demolition bombs could be built that would penetrate deck armor, but their tremendous weight of steel would allow only a small explosive charge For gravity to give the bombs sufficient velocity to pierce *the armor planes* would have to loose them from an altitude corresponding to the 10 000 foot high trajectory of shells fired *from* guns reducing the chances of a direct hit. And nothing else would do, for an armor-piercing bomb dropping in the water near a ship would carry too little explosive to harm it

In contrast a standard thin skinned demolition bomb acts like a mine if it explodes under water alongside a vessel Multiple, water tight compartments are the battleship s defense against such a "near miss" and a damage-control crew springs into action to stop leaks pump out flooded compartments, and restore the ship to an even keel

How to protect a big ship s superstructure against direct hits by demolition bombs which may cripple if not sink it remains a major problem confronting the world s admiralties One solution proposed by naval architects envisions warships of the future completely covered with turtleback armor, with virtually all the upper works removed and only the muzzles of big guns protruding from the carapace of steel! Whatever *form it may eventually take, however,* the majestic battleship remains the most invulnerable of all surface craft—as has been proved in actual bombing experiments upon old, scrapped, *and radio controlled U S* capital ships One had to be sent to the bottom by shellfire after repeated bomb explosions failed to sink it

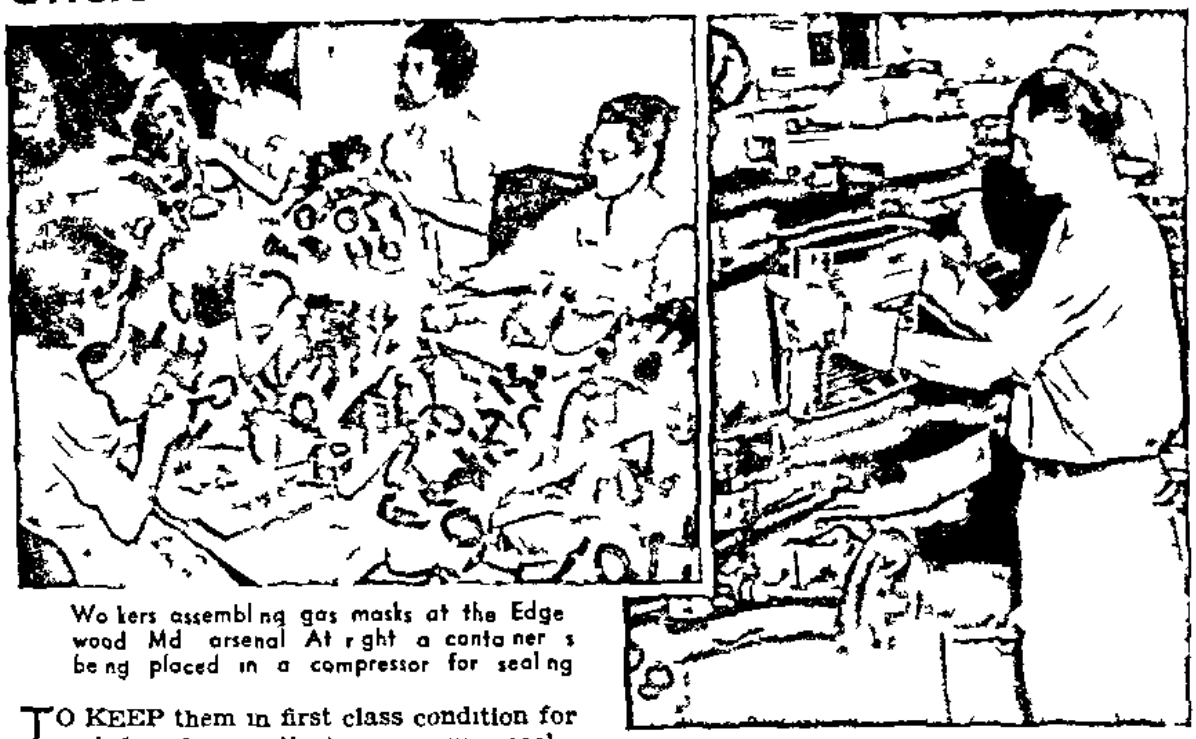
And now, how do all *the factors of air* power versus sea power add up? Evidently the balance is close—unless the scales are tipped violently, one way or the other, by the particular mission of the sea or air forces

If shore based bombers embark on a long-distance raid against an enemy fleet fuel load will limit their bomb capacity Lack of *escort planes, incapable* of flying so far will leave them open to attack by defending planes, as well as by antiaircraft fire Loss of valuable bombers is likely to outweigh the *military value of any* damage they might do

CONVERSELY, an admiral would be courting disaster by using his fleet to force a landing, or cover an evacuation of troops within easy range of a powerful enemy air base Only an emergency would justify the hazard It is a comforting thought that an invader s fleet would face the same warm reception from our own army s flying-fortress bombers.

But this country s grand stategy differs *as much from* that of Europe as the vast oceans that lap our shores contrast with land locked European waters For our defense, we picture *(Continued on page 228)*

Uncle Sam Vacuum-Packs His Gas Masks



Wo kers assembl ng gas masks at the Edge wood Md arsenal At r ght a conta ner s be ng placed in a compressor for seal ng

TO KEEP them in first class condition for periods as long as thirty years gas masks being manufactured at the U S arsenal at Edgewood Md are sealed in special vacuum containers After the masks have been assembled and tested they are placed in corrugated metal containers These are fed into a compressing machine which removes all air from the container and seals a metal lid in place To make doubly sure that no air leaks in the sealed containers are then soldered at the joints Eight hundred workers at the Edgewood plant are turning out masks at the rate of about 3 000 a day to build up a huge reserve supply for possible future need The photograph at the left above shows women workers on the assembly line attaching canisters to the otherwise completed masks while in the picture at the right a workman is shown placing the mask filled container in the compression machine for sealing

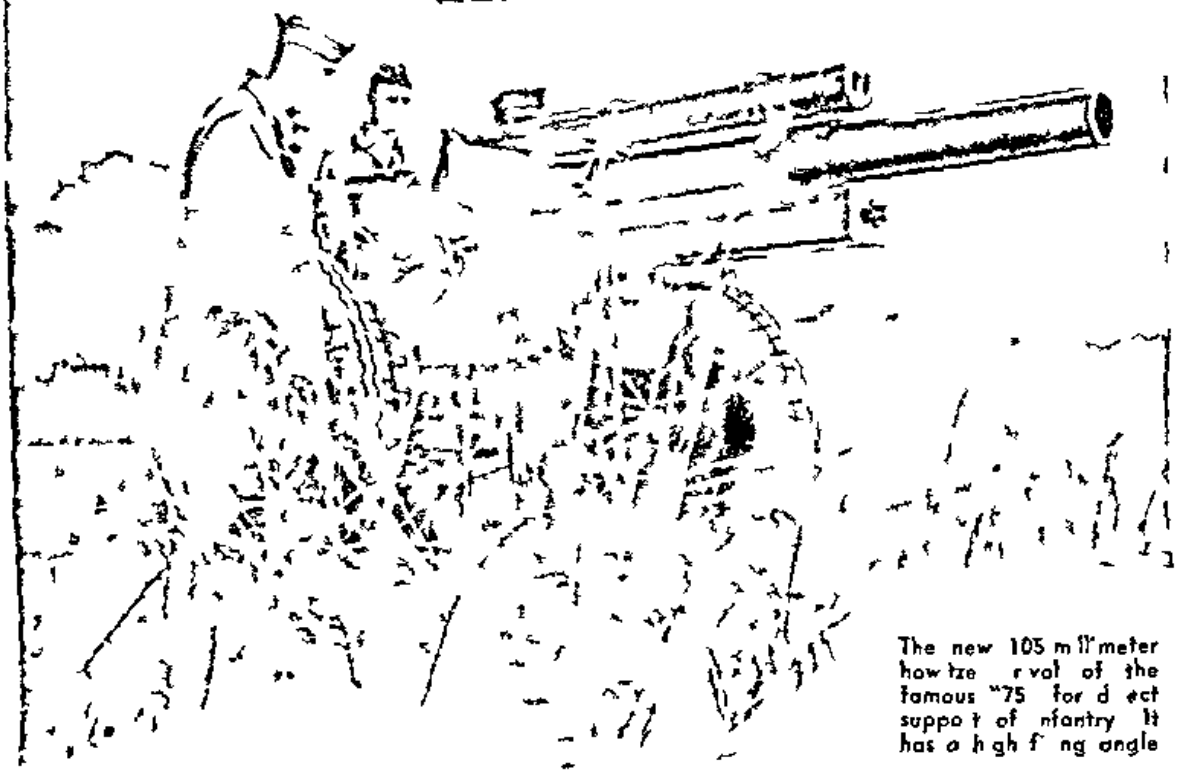
Army Shooting Match Tests New Rifles

Two semiautomatic rifles—the Garand which fires eight shots without reloading and the Johnson which fires eleven successive shots—were tested recently in a demonstration shoot by soldiers at Fort Belvoir Va for the benefit of members of the Senate and House Military Affairs Committees The Garand has been adopted for Army use.



Cong essmen keep score as doughboys put the Garand and Johnson rifles through the r paces

More Guns To Defend AMERICA!



The new 105 millimeter howitzer rival of the famous "75" for direct support of infantry It has a high firing angle

NO ONE ever heard a fighting soldier complain that his army had too much artillery

To most Americans and even to some American Army officers last spring's European war on land brought a succession of stunning surprises The defense numbing effectiveness of attacks by massed tanks the tremendous hitting power of armored divisions breath taking successes won by dive bombers spectacular achievements by dare-everything parachute troops insidious behind the lines activities of fifth column agents—these developments in the ancient and sometimes honorable trade of war resulted in a quantity of hard thinking by American officers One of the effects has been a mental rush toward mechanized war weapons the mere mention of which only a year ago would have made the faces of traditional minded infantry colonels and hard swearing cavalry brigadiers turn purple with rage

Perhaps in a few cases this trend toward mechanization has hardened into a dangerous belief that mechanized weapons in themselves are a solution of all the complex problems of model 1940 war But most of our officers no matter to which arm of the service they may belong have refused to become blind worshippers at the shrine of the militarized monkey wrench They appreciate fully the value of the new war machines but that appreciation hasn't shaken their conviction that the time tested combat team of infantry and artillery remains the backbone of every army and that only artillery can make it possible for attacking infantry to advance and for defending infantry to hold its ground

Adequate artillery support in battle usually means comparatively light infantry losses The regular artillery armament of our big World War divisions of close to 30 000 men consisted of forty-eight 75 millimeter guns and twenty four 155 milli

meter howitzers It was so inadequate that whenever an infantry d vision w as called on to make an assault its artillery had to be reenforced by the artillery of a divis on in reserve Even then infantry assaults d dn t always succeed and infantry losses too often were high But when the art llery of *three* d visions was used to support the ad vance of the infantry of one success came qu ckly and the infantry s losses were light

The war strength of our Regular Army s new tr angular or streaml ne division is about 12 500 men Its three small regiments of infantry are armed with semiautomatic rifles machine guns mortars and 37 milli meter ant tank guns Its art llery con sists of a regiment of thirty s x 5 mill meter guns and a regiment of sixteen 155 m ll meter ho vitzers

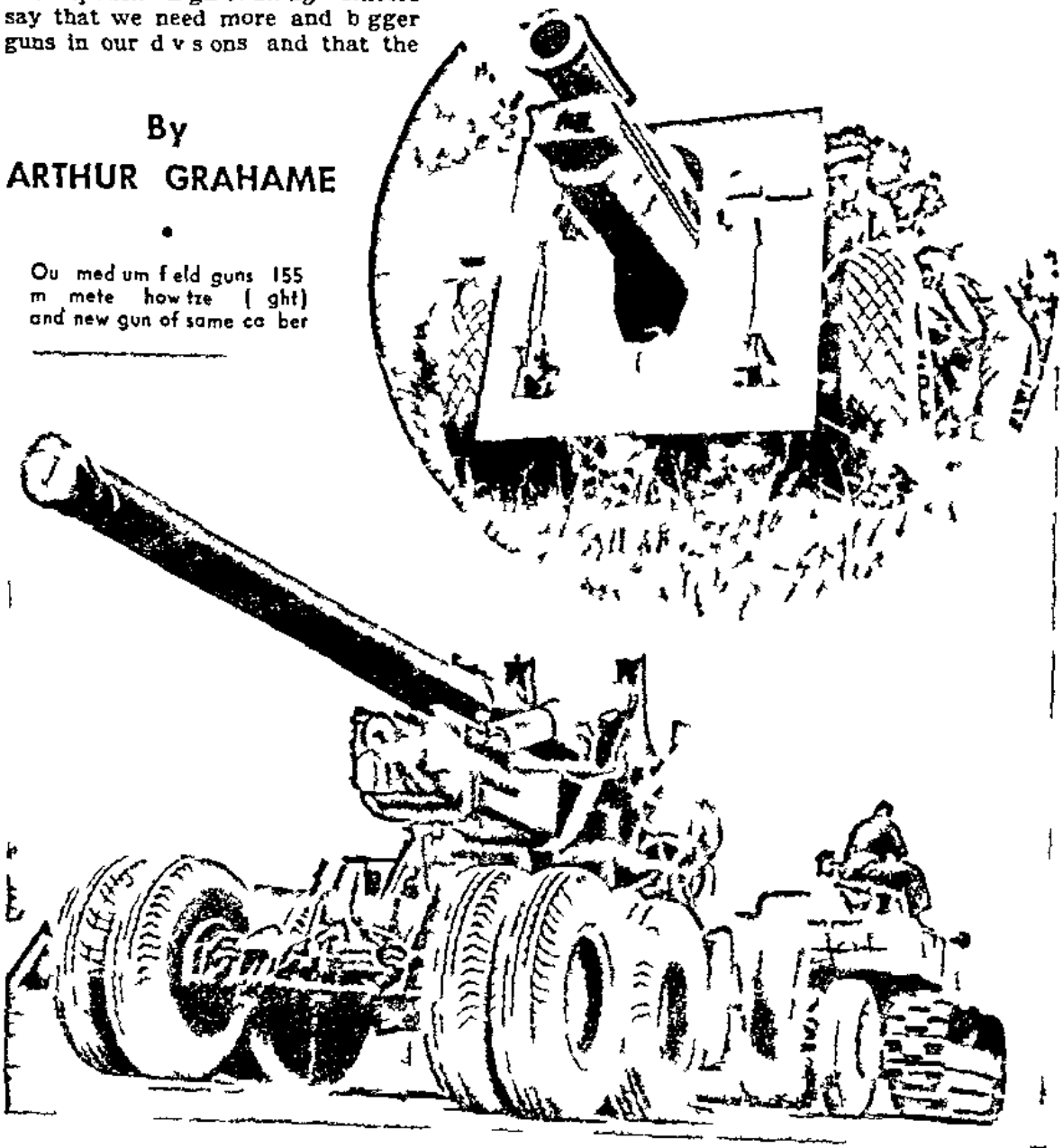
Outspoken h gh rank ng officers say that we need more and b gger guns in our d v s ons and that the very least we should do is to increase the number of 15o millimeter howitzers from sixteen to twenty four We re a rich country —rich enough to buy all the guns we need to defend ourselves against any enemy but not rich enough to pay for the life of a sin gle soldier killed unnecessarily because we fail to see to it that the Army get the guns it needs to do its national defense job

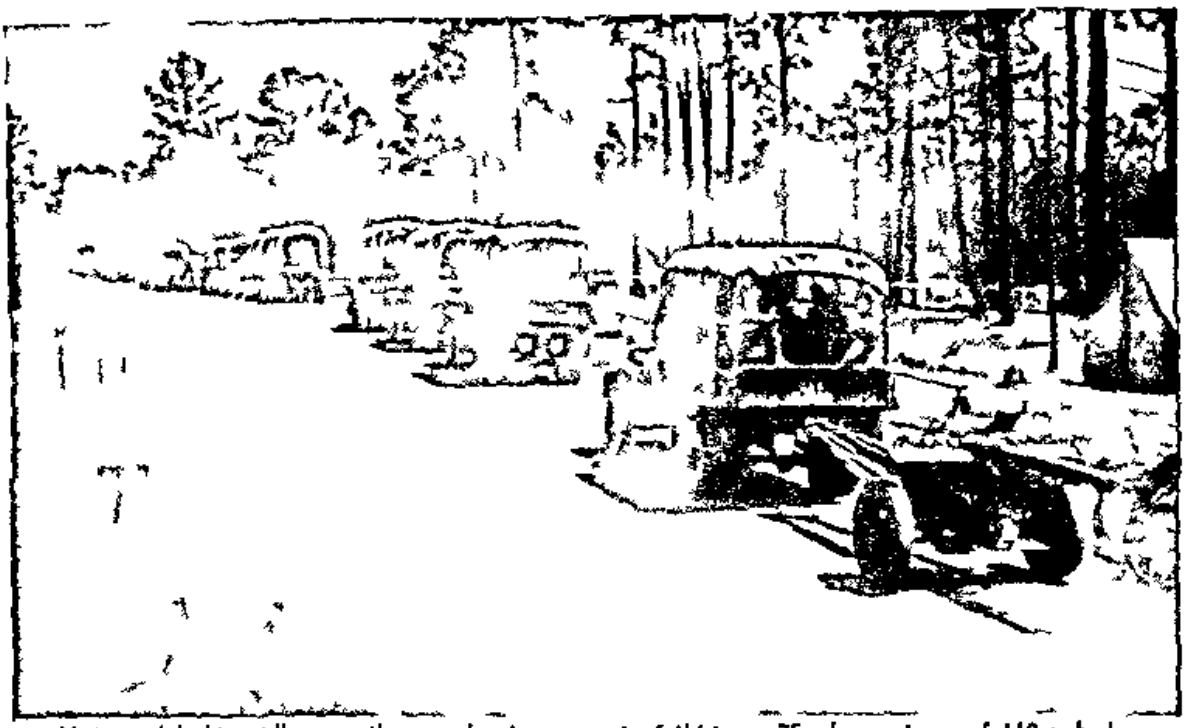
At present our standard light artillery weapon is the "5 millimeter—about three inch gun Contrary to common belief the guns our army is using today aren t the famous French built 1897 model 75 s with which we fought in France but guns built from French designs in American Army

By
ARTHUR GRAHAME

•

Ou med um f eld guns 155 m mete how tze (ght) and new gun of same ca ber





Moto zed l ght art llery on the mo ch A reg ment of thirty s x 75 s has a tra n of 110 veh cles

arsenals late in the World War and shortly after it With the or ginal carriage they had a maximum range of five and a half miles With the new American designed M 2 high speed carriage which permits an elevation of forty five degrees and a trav erse of eighty five degrees their range is over seven and a half miles

The Army has a stock of well over 4 000 of these guns Some are being used by the Regulars and the National Guard and the rest are in storage Although they are old enough to vote most of them are as good as they were the day they were finished Modernized with the M 2 carriage at a cost of about $8 000 each they are the equals of any guns of their cal ber in the w orld

All our field artillerymen speak affection ately of the 75 but not all of them are convinced that it is the best possible weapon for its primary purpose—the direct support of infantry with its fire Many of them think that the new 105 millimeter howitzer designed and after several years of experi menting recently perfected by our Ordnance Department, is more effective

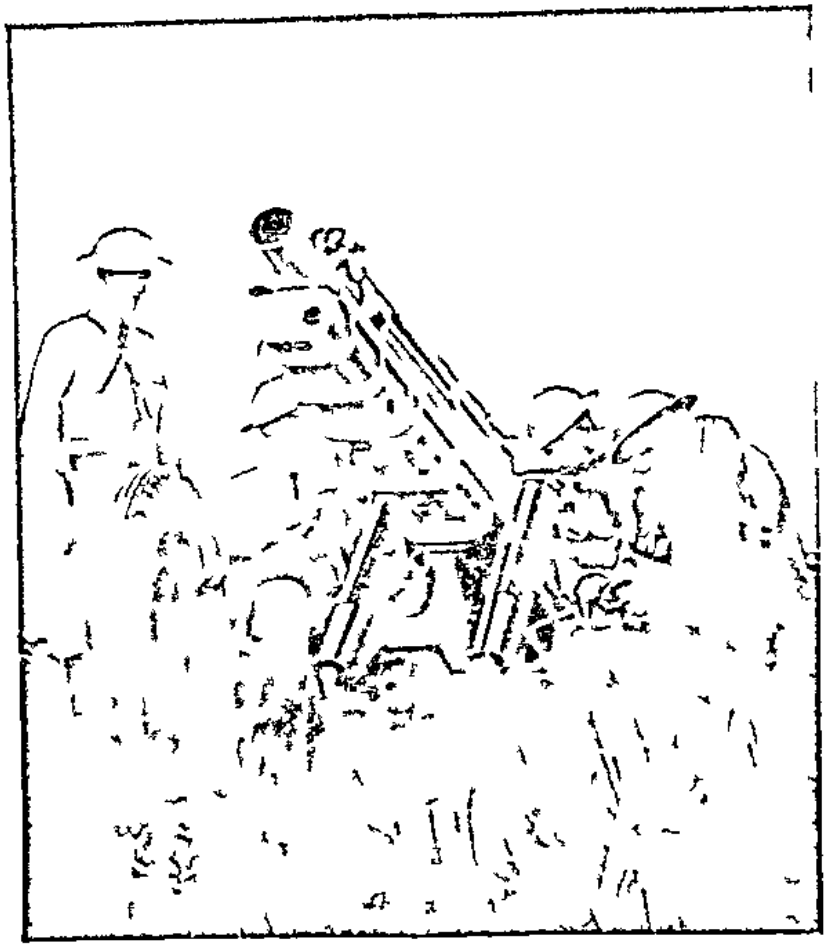
The greatest advantage of the 105 over the 75 is the larger bursting charge of its shell A battery of four 75 s can cover a front of 120 yards with its fire a battery of four 105 s can cover a front of 160 yards It takes an average of 800 fifteen pound 75 millimeter shells to blast a lane thirty yards wide through a barbed wire entangle ment thirty yards deep and 4 000 yards away an average of 525 thirty three pound 105 millimeter shells will do the job

Another advantage of the 105 is that in hilly or broken up country its high angle fire can reach targets which the flat tra jectory 75 gun can t touch One of the dis advantages of the 105 is that it weighs a ton more than the 3 650 pound 75 and so can t be moved quite so fast. Another is that its heavier ammunition requires more motor transportation—and even a regi ment of truck drawn 75 s has to have 110 vehicles to carry its men and equipment and 120 rounds of shell for its thirty six guns'

The potency of the 75 as a tank killer is a strong point in its favor. The French did great work with it against the German heavy tanks which their 37 millimeter anti tank guns couldn t do more than dent. Um p res at our maneuvers always flag down a tank and count it a casualty if it is unwise enough to make a target of itself within 1 000 yards or so of a 75 in firing position

OUR other light artillery weapon is the 75 millimeter howitzer also poison to tanks Hauled swiftly on the road or across country by half tracks it gives artillery support to our Mechanized Cavalry Brigade. It also is bu lt in a pack model weighing only 1 470 pounds which taken apart, can be carried by six mules Throwing a fifteen pound shell well over five miles this pack howitzer would be a mighty useful weapon if we ever had to fight in the sort of rough country which is common in some of our outlying possessions and in the vicinity of the Panama Canal

Our medium artillery consists of an undisclosed number of 155 millimeter howitzers—modernized four ton World War guns which fire a ninety five pound shell seven miles and which towed by trucks can do about 140 miles a day on the road



Poison to tanks our 75 millimeter howitzer has won its place as artillery support to hard hitting cavalry

NEWEST and longest ranged of our heavy artillery weapons is the fifteen ton 155 millimeter gun which has a range of fifteen miles Towed by tractor it can be moved 100 miles a day French built World War guns of the same caliber which we still have in service have a range of ten miles Our heaviest field gun is the 240 millimeter howitzer—a tractor hauled thirty ton monster which throws a 345 pound shell nine miles

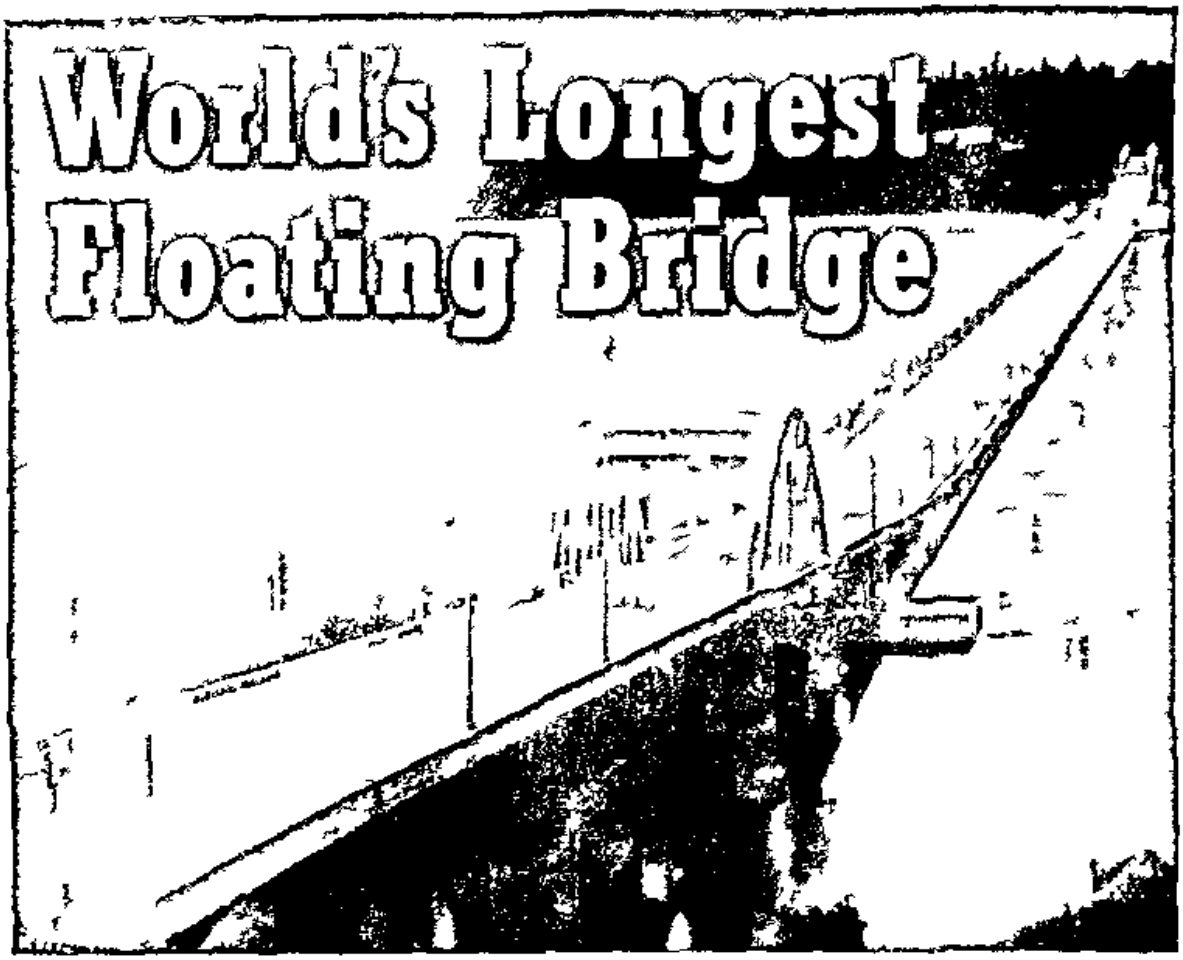
There still are some field artillery regiments whose guns are galloped into action to the stirring accompaniment of thudding hoofs and rumbling wooden wheels In all probability, there will be a few of these picturesque horse drawn gun regiments in our Army for a good many years to come There's plenty of rough country left in the Americas and in real rough country fighting a horse drawn gun can move around faster than a truck drawn gun But almost three quarters of our light artillery has already been motorized as well as all our medium and heavy artillery

The reason for the change is that motorized artillery can move faster and farther on the road With its six horse team galloping a seventy five millimeter gun can be moved for a strictly limited distance at a top speed of about twelve miles an hour A motor truck can haul a 75 mounted on a pneumatic tired high speed carriage *(Continued on page 230)*



For rough country a special model of the 75 howitzer is taken apart and carried on six army mules backs

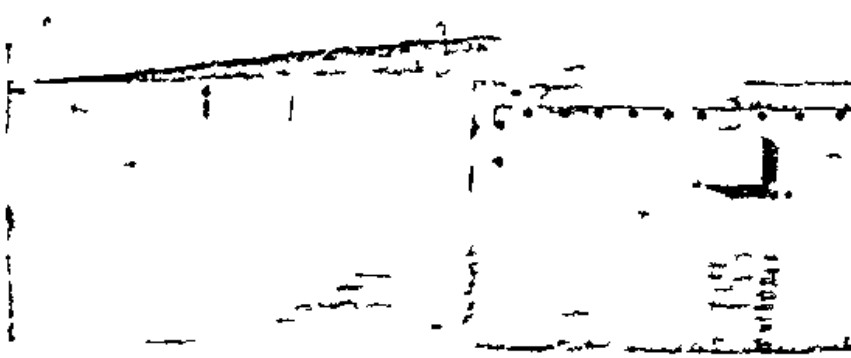
World's Longest Floating Bridge



The 1/4 mile concrete pontoon bridge across Lake Washington as it appears when illuminated at night

TOLL gates swung open recently to mark the completion of one of the great engineering feats of all time—the daring construction of a mile and a quarter vehicular bridge that floats on the surface of the water Connecting the peninsular city of Seattle Wash with the mainland to the east, the floating bridge by far the longest of its type in the world is the key link in a $9 000 000 highway project that also involves more than five miles of steel arch bridge viaducts twin tunnels and connecting highways In effect the project moves the city of Seattle fourteen miles eastward since it provides a short cut for traffic to and from the heart of the northwest metropolis

Tied together with huge bolts and anchored securely to the bottom of Lake Washington twenty five giant air filled concrete pontoons form a broad four lane thoroughfare Cast in deep molds as large as a city block the concrete pontoons were floated to the spot and bolted to each other after engineers had completed long months of research on velocities of winds and waves strength of the pontoons expected weight of traffic routes of water craft and seasonal changes in the lakes water level To tie the span down construction experts used

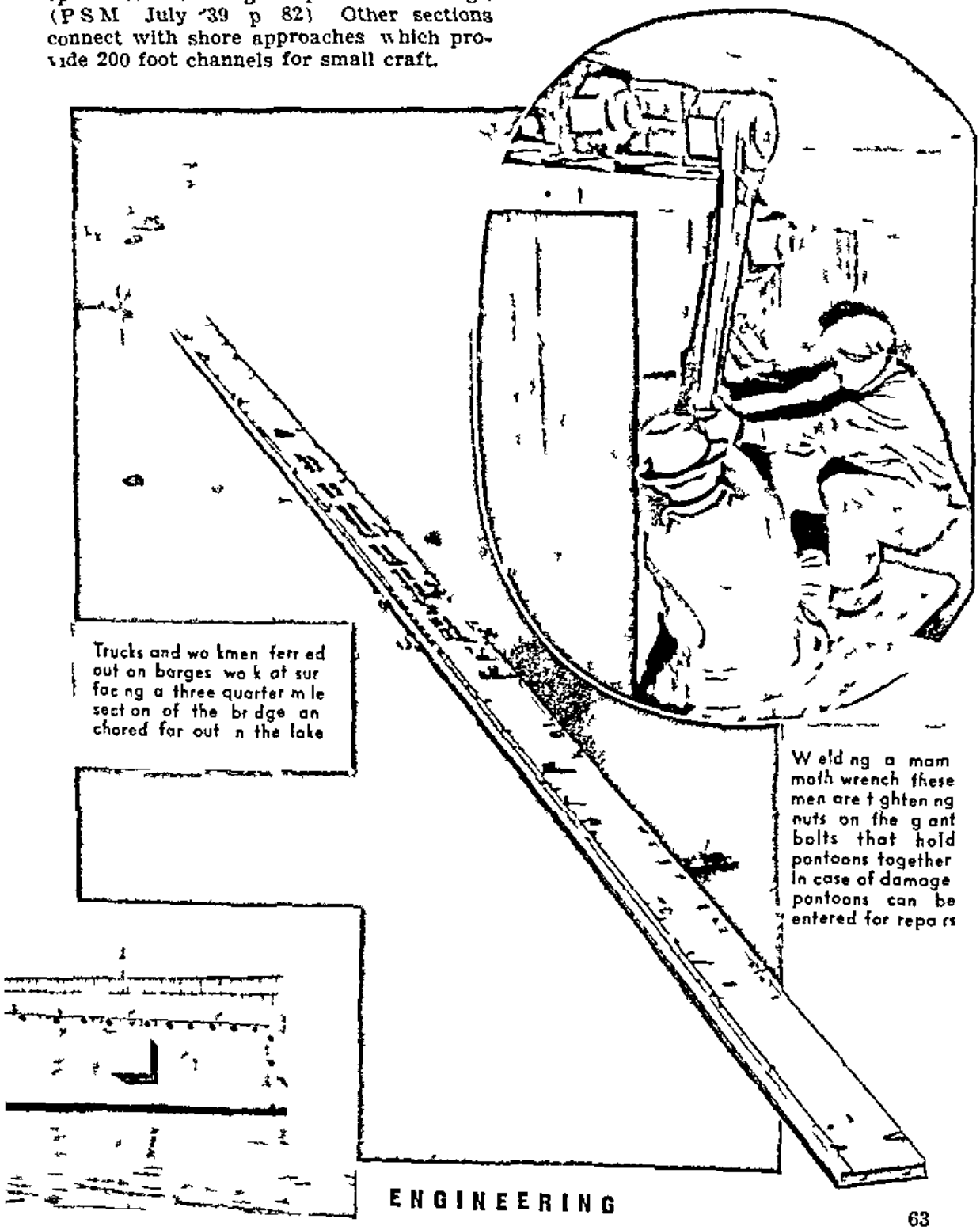


One of the sections of the sixty foot wide floating highway before it was locked into place Note the tongues at the end which fitted into grooves in the next section

forty concrete anchors each tipping the scales at sixty five tons and equipped with hydraulic nozzles by which they dug themselves deep into the soft lake bottom

In its completed form the floating bridge really has four solid rigidly bolted sections The middle section a single concrete girder 4 520 feet long is actually the longest boat in existence The section near an island over which the bridge route passes contains a 378 foot draw link which can be opened to allow large ships to sail through (P S M July '39 p 82) Other sections connect with shore approaches which provide 200 foot channels for small craft.

Special connections between the floating span and the shore approaches allow for contraction or expansion due to weather for side motion of the span during violent storms and for vertical movement caused by a rise or fall in the lake level The water itself absorbs the weight and jar of traffic Engineers figure that if all four eleven foot lanes were jammed with loaded trucks the bridge would sink into the water for a distance of only six inches

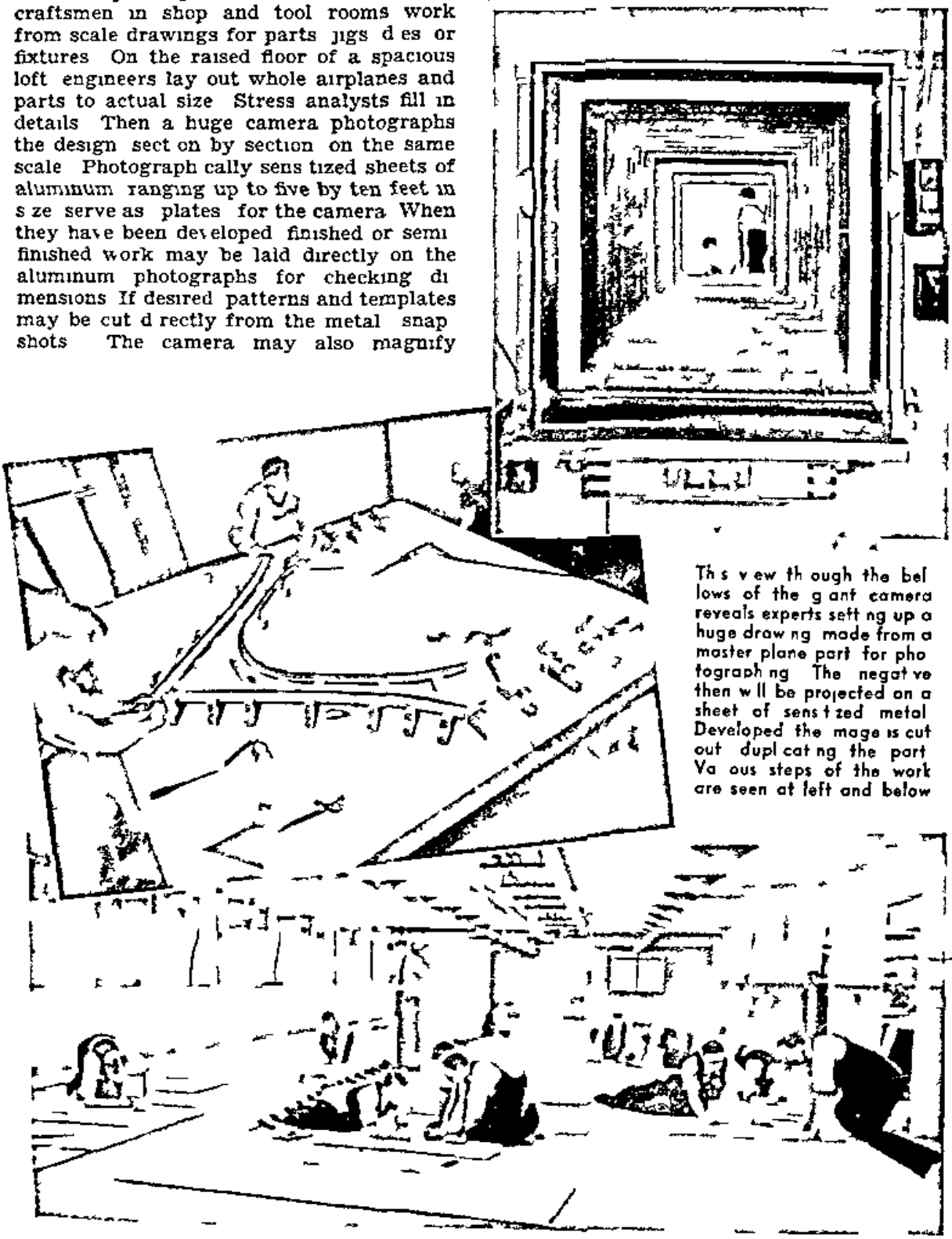


Trucks and workmen ferried out on barges work at surfacing a three quarter mile section of the bridge anchored far out in the lake

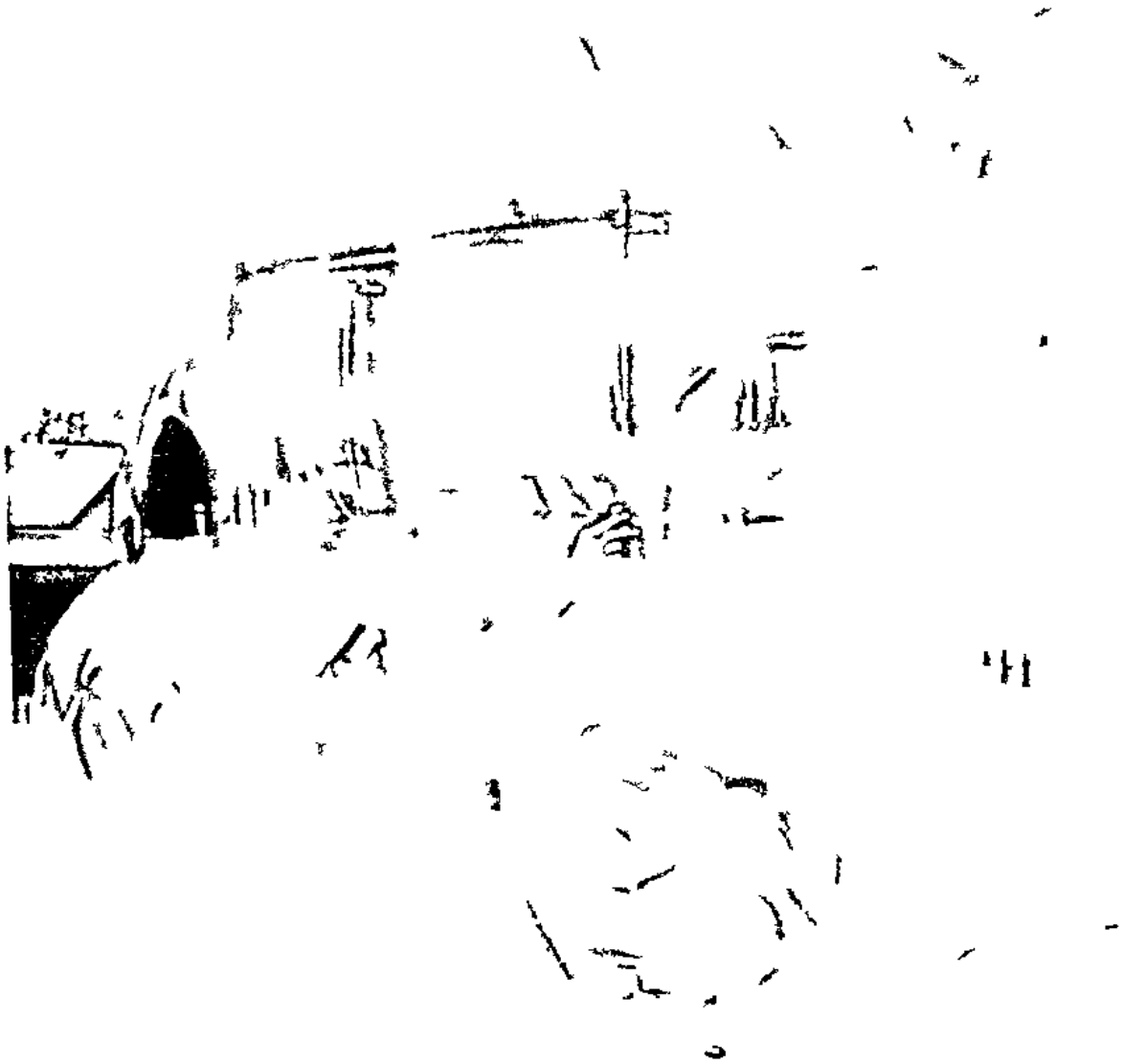
Welding a mammoth wrench these men are tightening nuts on the giant bolts that hold pontoons together In case of damage pontoons can be entered for repairs

Photos Replace Airplane Plans

PHOTOGRAPHY on a giant scale is helping the Glenn L Martin plant at Baltimore Md to play a leading part in speeding up national airplane production No longer do craftsmen in shop and tool rooms work from scale drawings for parts jigs dies or fixtures On the raised floor of a spacious loft engineers lay out whole airplanes and parts to actual size Stress analysts fill in details Then a huge camera photographs the design section by section on the same scale Photographically sensitized sheets of aluminum ranging up to five by ten feet in size serve as plates for the camera When they have been developed finished or semi finished work may be laid directly on the aluminum photographs for checking dimensions If desired patterns and templates may be cut directly from the metal snap shots The camera may also magnify drawings in order to allow for shrinkage in castings It is estimated that the new process is saving $80 000 a year at the Martin plant in engineering costs



This view through the bellows of the giant camera reveals experts setting up a huge drawing made from a master plane part for photographing The negative then will be projected on a sheet of sensitized metal Developed the image is cut out duplicating the part Various steps of the work are seen at left and below



6,000 autos a Day!

In the assembly l ne the body of a new Fo d s lowered onto the chass s

FIVE MILES west of the heart of Detro t Mich on the banks of the River Rouge is the largest s ngle manufacturing plant in the world Sprawled over land that could accommodate more than 1 000 foot ball gridirons this Gargantuan fac tory employs 80 000 men and can turn out 6 000 automobiles in a single two



STEELS FOR CARS
Mammoth furnaces and foundries transform ore into steel and iron Here steel pours from an open hearth furnace

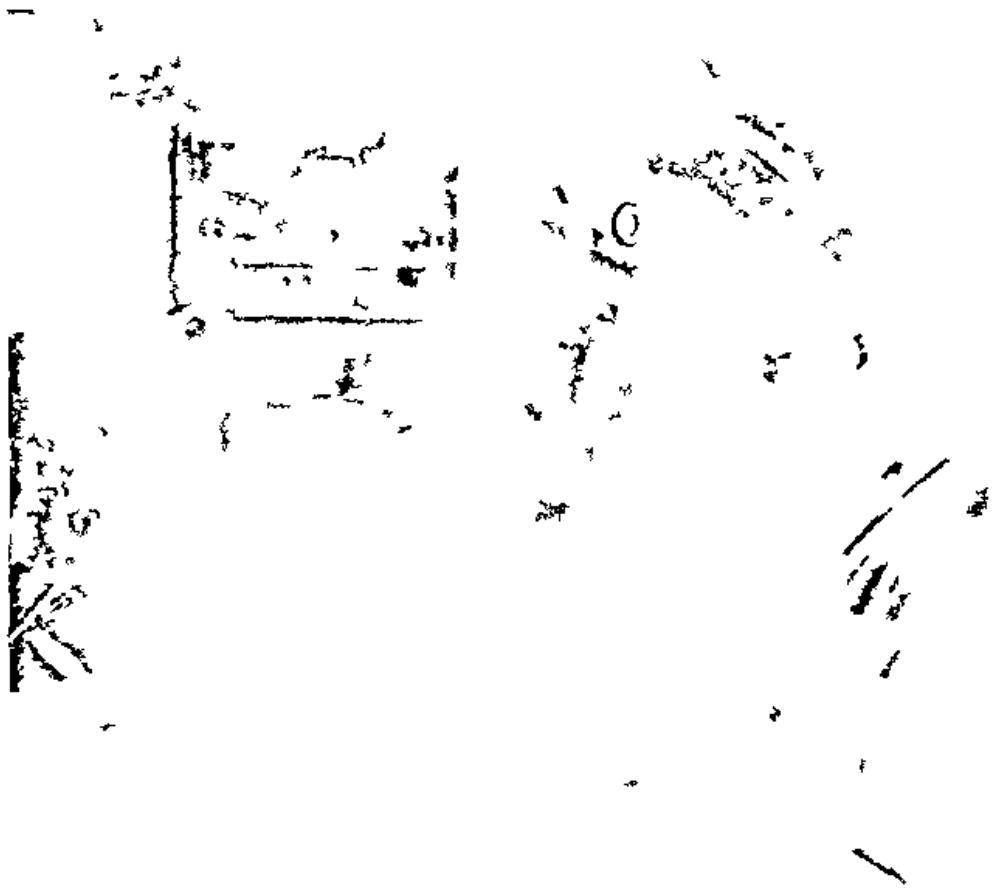
By E. W. MURTFELDT

shift sixteen hour day That's better than one complete ready to run car every ten seconds

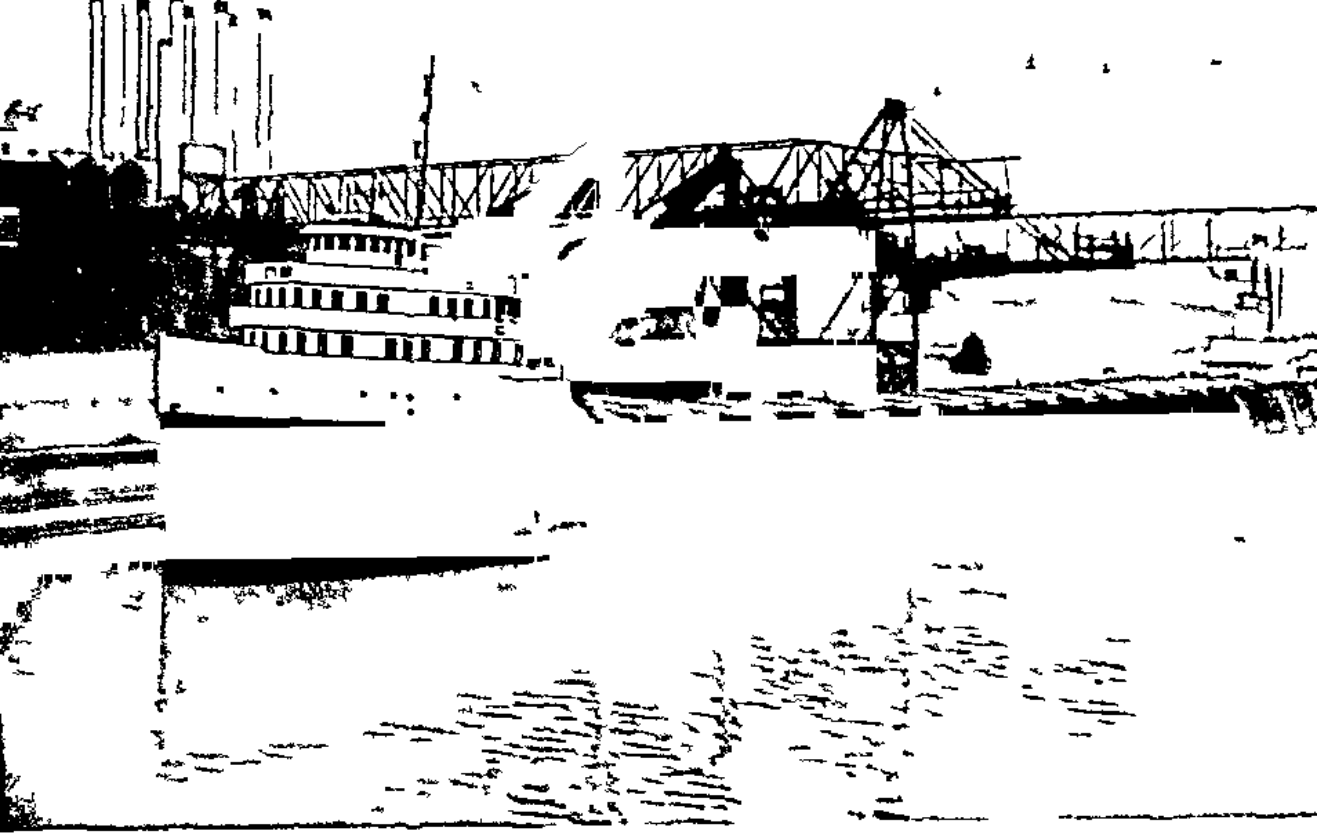
A bird's eye view of the maze of blast furnaces rolling mills tool and die shops power houses ore docks railroads foundries laboratories and offices in this giant Ford Motor Company plant presents the first impression of one vast chaotic tangle Yet by a miracle of science and industrial organization the sprawling parts are blended into a clockwork unit that at one end sucks in raw materials and at the other blows out a steady stream of gleaming motor cars

To get any idea of the tremendous size of this manufacturing monster and of the miracle of production it accomplishes you have to begin at the beginning which means that you run into this fact The origins of the vehicles that come from this mammoth mechanical hatchery are scattered over the face of the earth

For the Rouge plant taps the raw ma



CYLINDER BLOCK
Cast in one piece an eight cylinder engine block is seen at the right in a multiple spindle drill which drills and taps nearly fifty holes at once



The D esel powered lake fre ghter Henry Fo d II flagsh p of the Ford fleet unload ng iron ore

terial resources of the world Up from Bra zil and the Far East come boatloads of raw rubber for tires and bodies Down through the western Great Lakes flows a steady stream of long barges stuffed with iron ore for the blast furnaces Coal trundles in from the South So vast is the demand of the factory for materials that officials state that the plant taps not only many foreign lands but also practically every one of the 3 070 counties in the United States for at least one contribution to its finished product

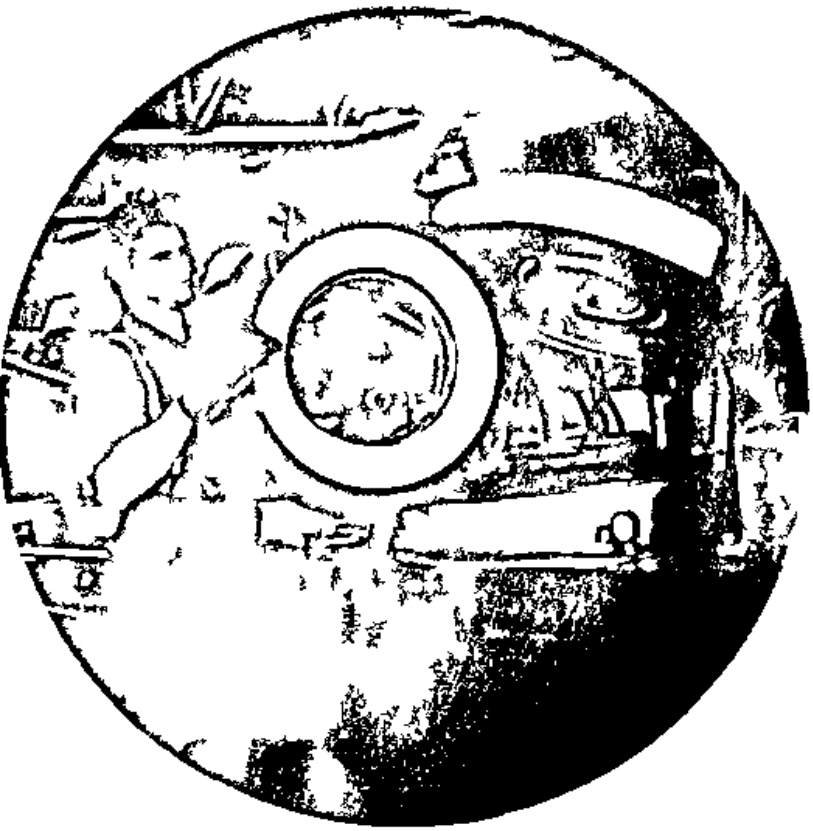
Trains and trucks haul their quota of materials to the plant but the lion s share of the transportation job is intrusted to ships The Ford company maintains its own freighter fleet of twenty nine vessels led by the 614 foot Diesel powered flagship *Henry Ford II* Up the River Rouge the freighter armada noses up to the factory s huge un loading pier where giant mechanical fists grab fifteen ton handfuls of iron ore and dump them into a vast storage bin that lines the side of the boat wharf

On schedule and without interruption this influx of raw materials spreads out from docks and receiving platforms along trans portation fingers that lead to the maze of manufacturing and processing plants For this distribution job there are 100 miles of railroad track within the Rouge boundaries Over this network of steel ten steam loco motives and seven oil electric engines haul more than 1 000 plant freight cars There are fourteen giant locomotive cranes as well as fleets of trucks tractors and trail ers And what this transportation army cannot handle is intrusted to a conveyor belt system that is long enough to stretch from New York City to Wilmington Del and ranges from heavy mechanisms to move bulky raw materials to light conveyors that speed small parts into the hands of work men when and where they need them

Either in their original or in their proc essed form all these materials are ulti mately destined for the spinal column of the factory the final assembly line But most of them face a long journey before they are joined to the automobile skeleton to play their part in forming the finished car

Take for example one raw material iron ore of which some 850 000 tons arrive at the Rouge docks in a single season The raw ore is fed into the maws of two giant blast fur naces that in twenty four hours can turn out 1 500 tons of pig iron As it emerges the flow splits some of the iron moving into the seventeen acre foundry to be made into

A VISIT TO AN INDUSTRIAL WONDERLAND . . . THE LARGEST FACTORY IN THE WORLD



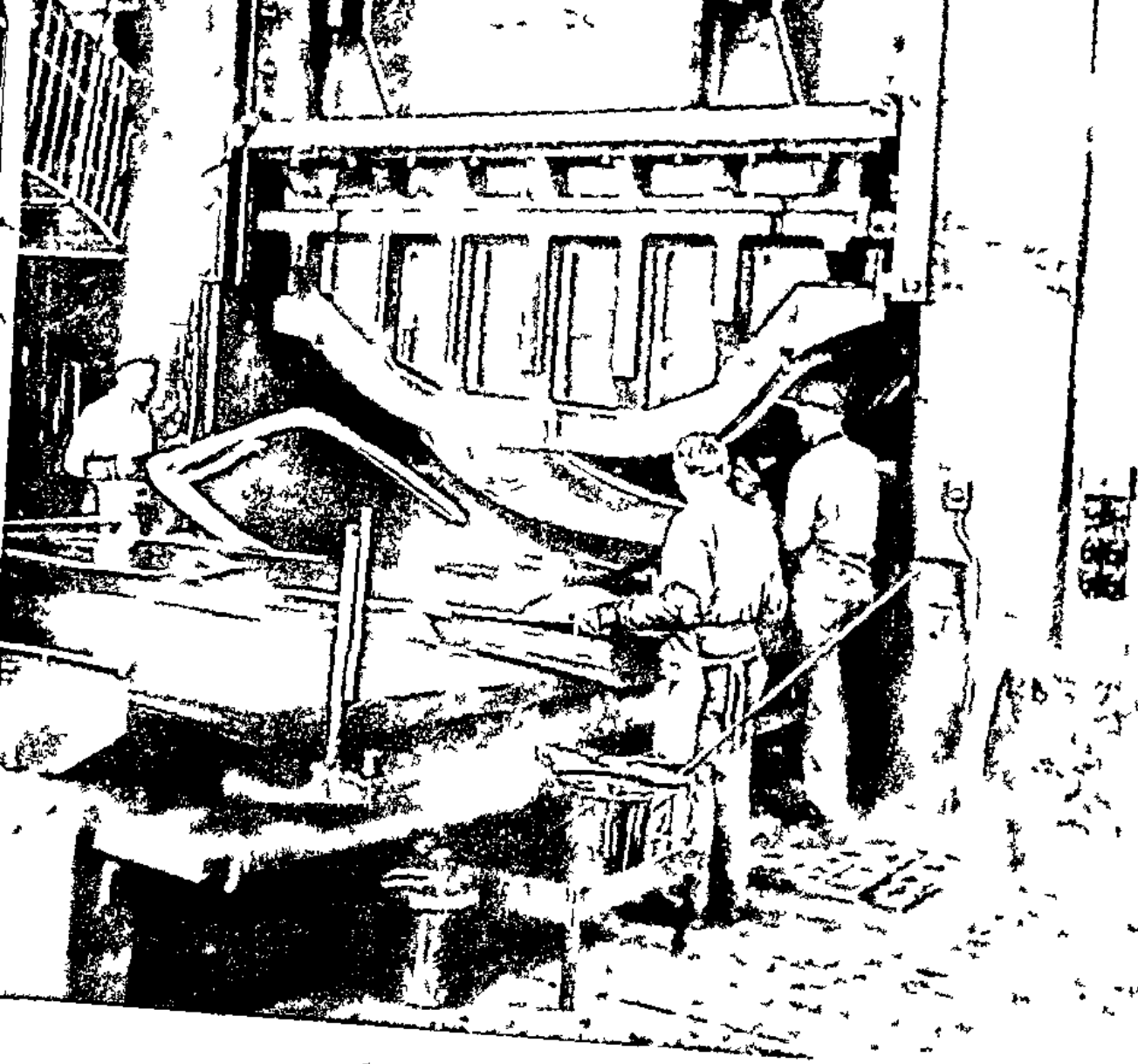


RUBBER FROM BRAZIL AND THE FAR EAST goes nto the mok ng of t es and of rubbe body parts Abo e a wo ke n the huge new t e plant s seen re mov ng a b and new wh te wa ed t e f om the cu ng mold

MASS PRODUCTION OF UPHOLSTERY Us ng elec t c kn es these wo ke s n the upho ste y plant a e cutt ng f fty p eces of cloth at once fo seat cove s

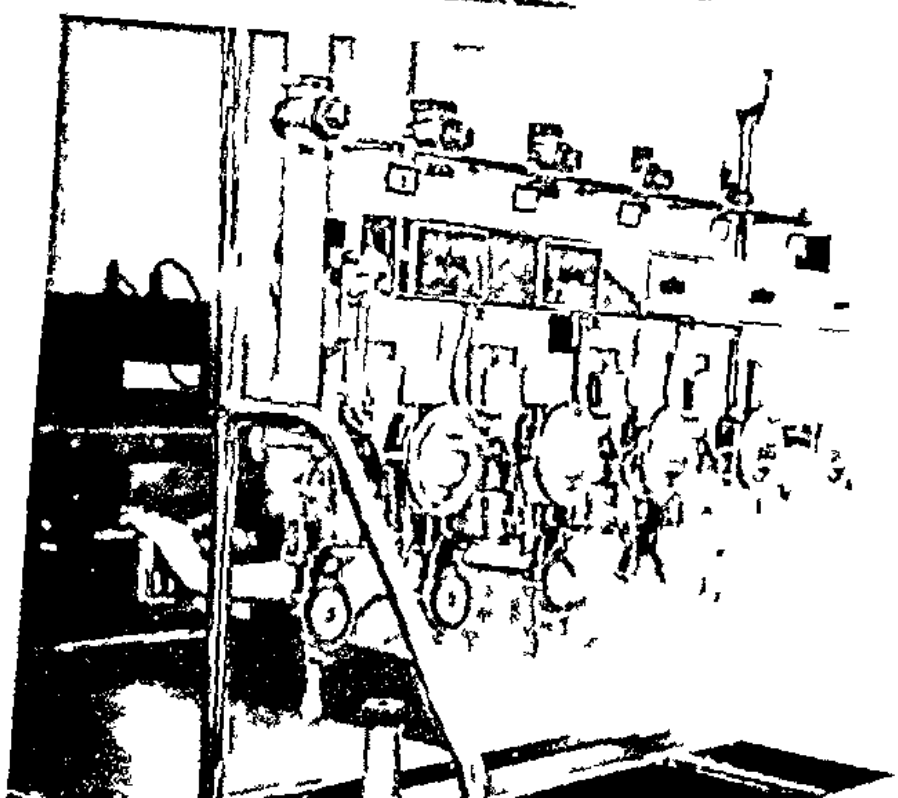






SHAPING THE BODY

G ant presses stamp large and small body parts from sheets of steel The p c ture above shows how body tops are produced There are 2 000 power presses the most powerful of wh ch exe t an 800 ton pressure



PRECISION TESTING

The del cate nstrument at the r ght s be ng used to gauge the th ckness of the copper plat ng upon a con nect ng rod bea ng Th s s one of the nnumerable tests to ma nta n accuracy



BAKING ON THE BODY FINISH
After the body is assembled it is cleaned and painted with a synthetic enamel which is then dried by lamps as pictured above

castings including the one piece eight cylinder Ford engine block

Another stream of iron in molten state moves into the open hearth building where in ten huge furnaces it merges with scrap iron limestone magnesium chrome vanadium and various other alloys to be converted into the sixty three distinct types of steel that go into the manufacture of Ford built cars

Follow the trail farther On conveyors ingots of steel travel to the rolling mill—twenty two acres—where gigantic machinery rolls them into bars or rods or wide coils of sheet steel Go on into the press shop—nineteen acres—and watch a battery of 2 000 power presses some exerting an 800 ton squeeze stamp out fenders hoods radiators body panels and other parts as easily as a chef wields a cooky cutter

Near by in a connecting building you'll watch forty steam hammers and sixty upsetters a type of forging machine turn out springs and small parts Since the original pig iron entered the open hearth building its progress has gone on in separate shops that are all connected and covered by a single roof under which if you wanted to sweep out a few thousand tons of machinery you could lay out close to 1 000 tennis courts

But you've only followed the factory trail of iron ore To do the job right you'd also follow raw rubber through its maze of transformations into finished tires You'd follow silica and alkalis to their completed form as window and windshield glass You'd travel through the plant where oil is extracted from soy beans to form a constituent of body enamel and the remainder utilized in the manufacture of such plastic parts as distributor housings and ignition coil cases

But whatever material you follow it will eventually wind up somewhere along one of the three parallel final assembly lines To get an idea of what these are like think of a mammoth parade that starts with a small group at the beginning of an avenue that has side streets leading into it from the left On each side street groups of marchers are assembled into compact orderly units As the initial group reaches the first side street the assembled marchers there swing into line

A second group joins the parade at the next corner and so on until the parade is a single marching unit.

The same thing happens in an automobile final assembly line Starting the parade is the chassis which moves along on a conveyor until at the first side street the engine assembled in the motor building moves in on a conveyor from the left and is lowered into place Radiator steering gear fenders wheels bodies and other parts are added as the steadily expanding unit moves from one side conveyor along to the next And remember that each of these side street conveyors is an assembly line in itself for each major part has been built up from a number of smaller units Finally when the mechanism arrives at the end of the line it is a complete ready to operate automobile and rolls off the conveyor under the guidance of an inspector who drives it out onto a half mile test track for a check run

But long before you reach the point where finished cars roll off the assembly lines you will probably reflect that it must take power with a capital P to run the thousands of machines and light the myriads of lamps in a plant of this size It does The factory power house the largest industrial high pressure power plant in the world, utilizes three giant turbo generators that can produce enough current in a single day to meet the electrical requirements of the average American home for 13 533 years!

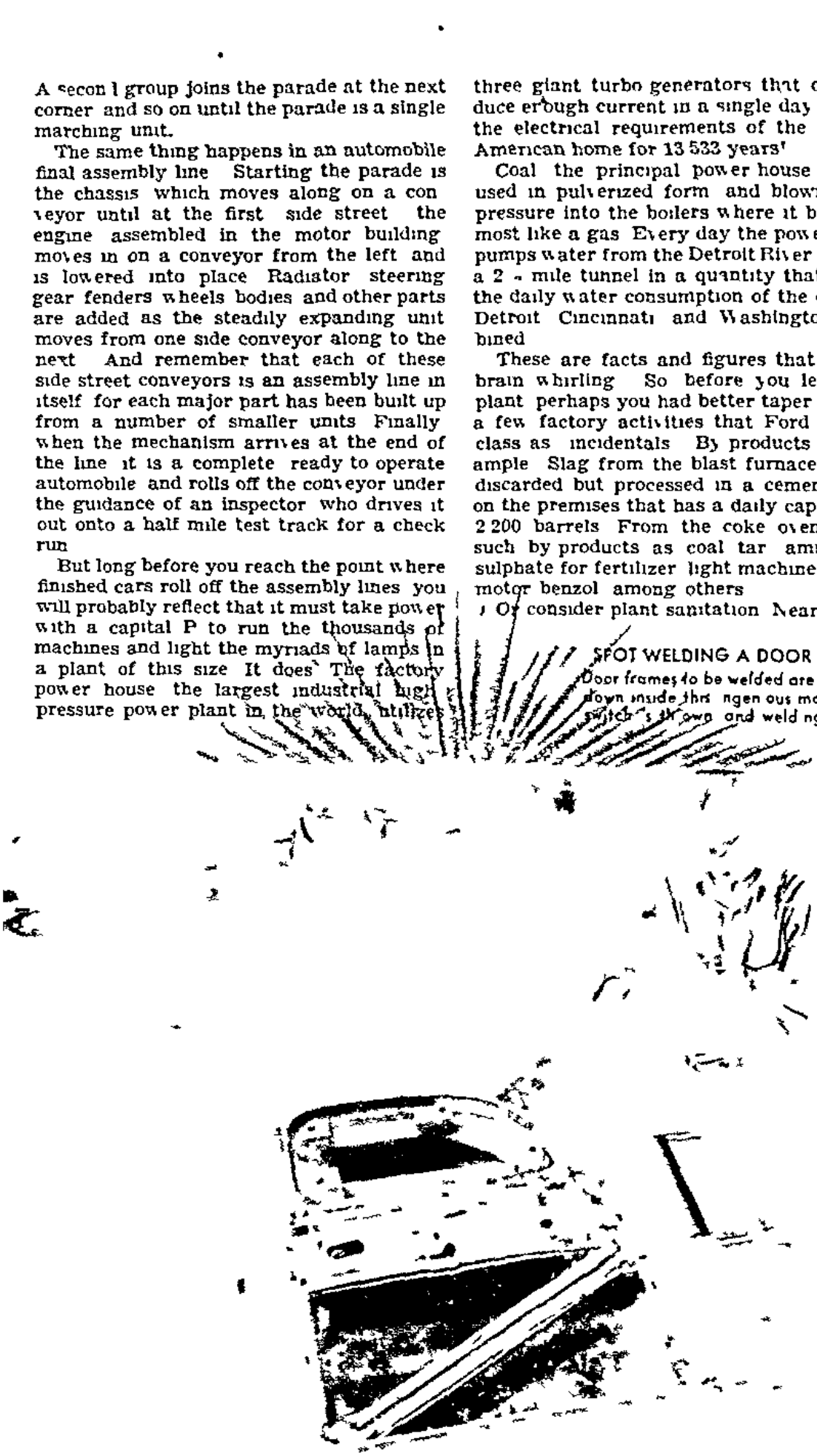
Coal the principal power house fuel is used in pulverized form and blown under pressure into the boilers where it burns almost like a gas Every day the power house pumps water from the Detroit River through a 2 - mile tunnel in a quantity that equals the daily water consumption of the cities of Detroit Cincinnati and Washington combined

These are facts and figures that set the brain whirling So before you leave the plant perhaps you had better taper off with a few factory activities that Ford officials class as incidentals By products for example Slag from the blast furnaces is not discarded but processed in a cement plant on the premises that has a daily capacity of 2 200 barrels From the coke ovens come such by products as coal tar ammonium sulphate for fertilizer light machine oil and motor benzol among others

Of consider plant sanitation Nearly 5 000

SPOT WELDING A DOOR FRAME

Door frames to be welded are clamped down inside this ingenious machine A switch is thrown and welding is done

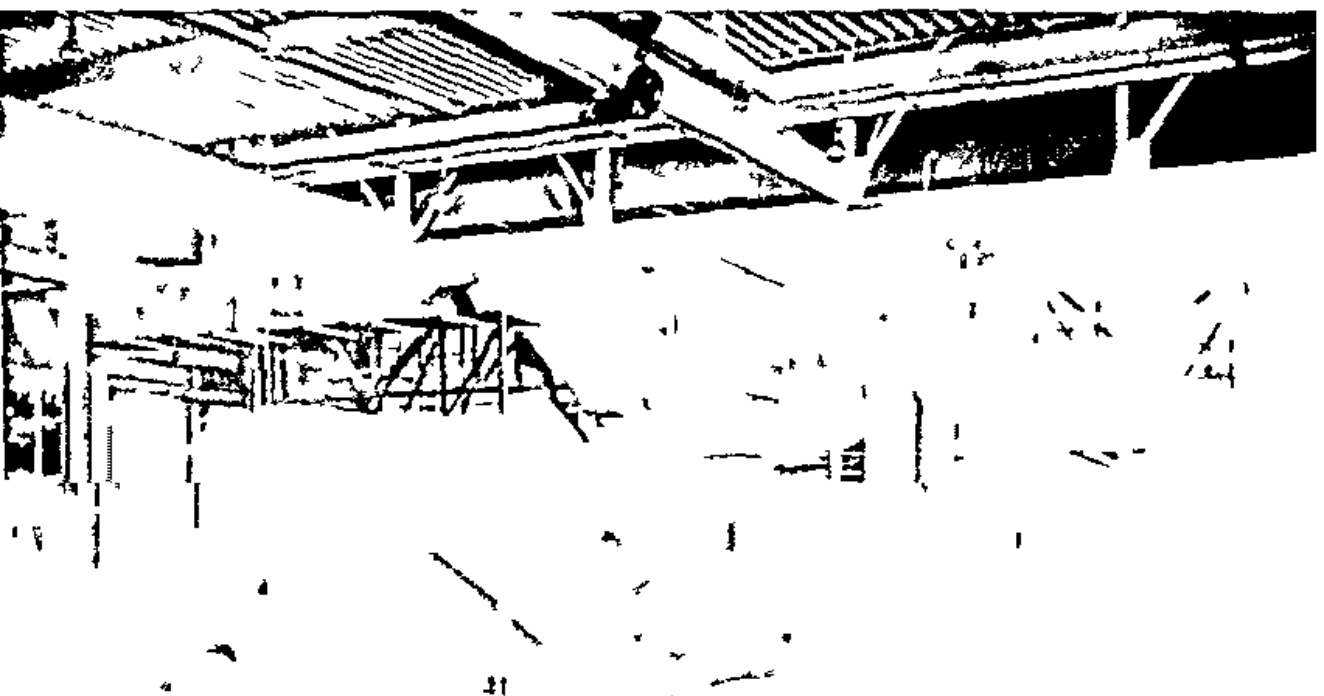


men are assigned to the job of keeping buildings and machinery clean and safe Each month they use around 7 000 mops 2 700 brooms fifteen tons of soap chips and 32 500 gallons of paint. The Rouge plant has more than 8 000 - 000 square feet of floor to be scrubbed and swept!

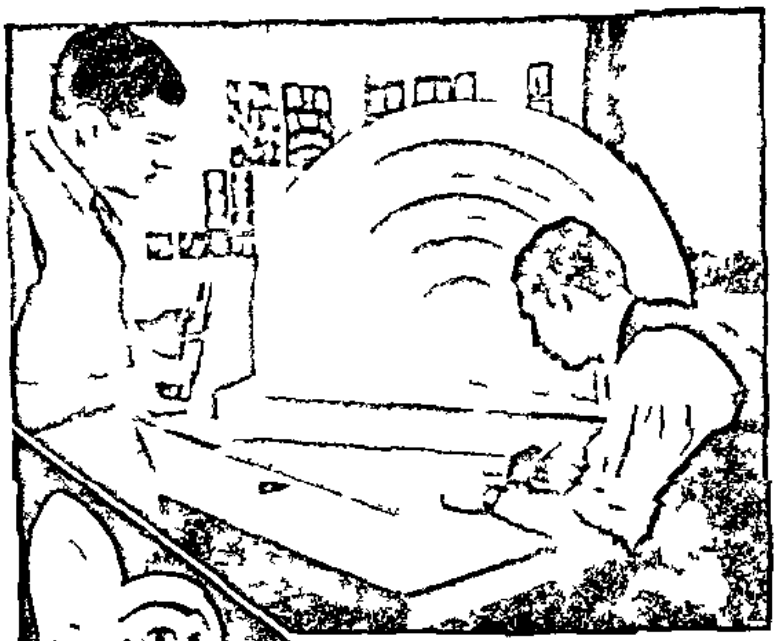
With its 6 000 cars a-day capacity the Piver Rouge plant is a tremendously important cog in the peacetime industrial life of the nation And with half a world already at war this giant factory along with others of its kind may become of even greater importance as a mighty factor in America s national defense because of its ability to switch over to tanks and guns and airplanes from its normal production of trucks tractors and automobiles



ASSEMBLY LINE Conveyors like the one at the right bring finished parts to workers on the assembly lines Below lamps are adjusted as completed cars roll off one of the three lines all ready for test runs and the road

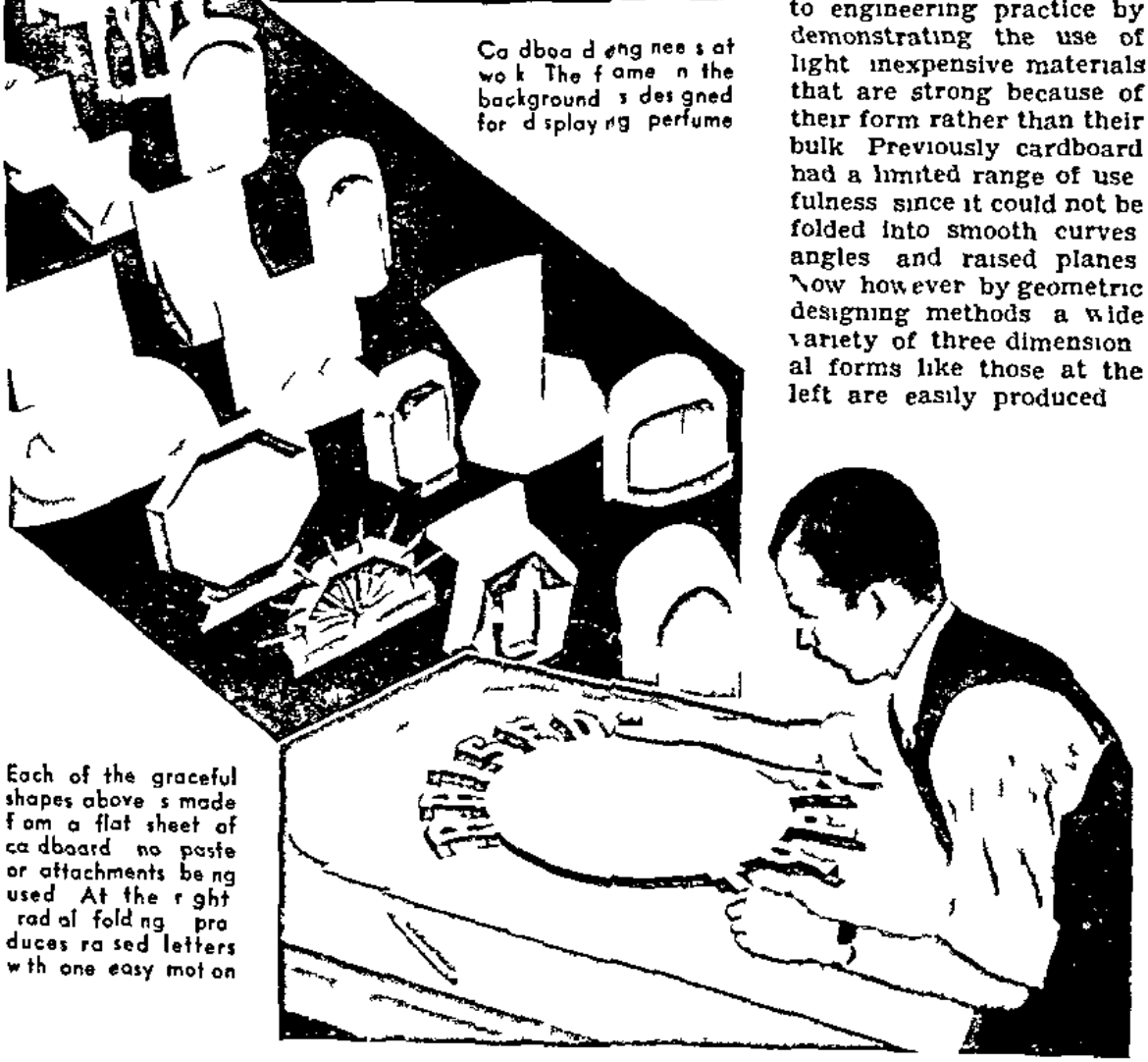


Working Wonders with Cardboard



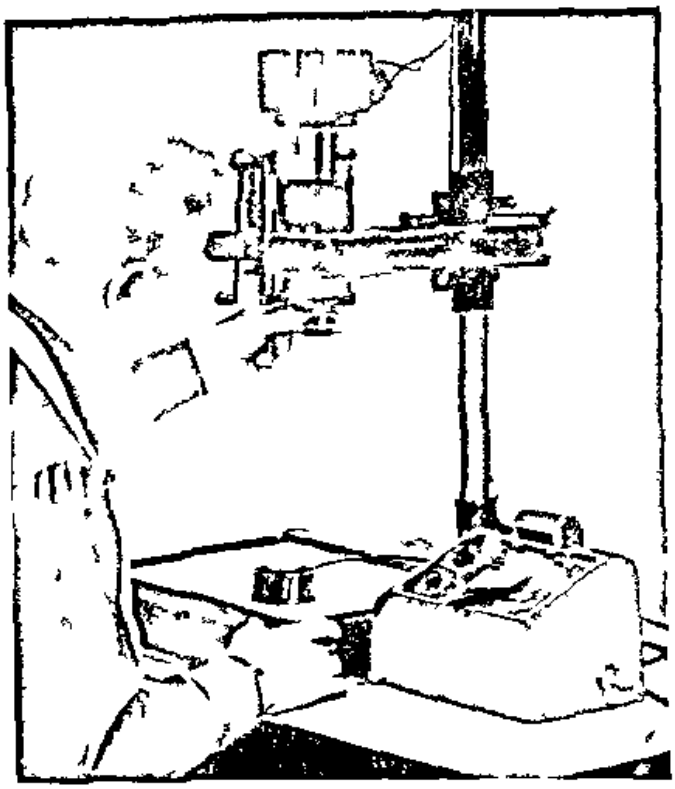
Ca dboa d eng nee s at wo k The f ame n the background s des gned for d splay ng perfume

COULD you fold a flat piece of cardboard one twenty fifth of an inch thick so that it would support two 150 pound men? It sounds impossible but by one of the methods developed by a Long Island City N Y group of card board engineers the trick is accomplished with ease Led by Richard E Paige the ex perimenters have invented six different methods for folding flat cardboard into strong three dimensional forms Their discoveries have already brought about great changes in the mil lion-dollar advertising dis play industry and are mak ing valuable contributions to engineering practice by demonstrating the use of light inexpensive materials that are strong because of their form rather than their bulk Previously cardboard had a limited range of use fulness since it could not be folded into smooth curves angles and raised planes Now however by geometric designing methods a wide variety of three dimension al forms like those at the left are easily produced



Each of the graceful shapes above s made f om a flat sheet of ca dboard no paste or attachments be ng used At the r ght rad al fold ng pro duces ra sed letters w th one easy mot on

LATEST AIDS FOR



Turret View Finder for Movie Camera

VIEWING the scene to be recorded with a home movie camera equipped with three lenses mounted on a tur ret is simplified by the addition of a miniature turret holding a trio of viewing lenses each showing the same area as one of the main lenses By bringing the corresponding view ing lens into position the area in cluded by each taking lens is seen



There s a v ew ng lens for each of three tak ng lenses on th s home movie camera

Enlarging Meter and Timer

ENTIRELY automatic a meter just marketed not only determines the number of seconds needed for an enlargement exposure but also controls the ex posure shutting off the light at the proper time No test strips are required The device adjusts itself automatically for prints of various sizes in which the light source is nearer or farther from the paper



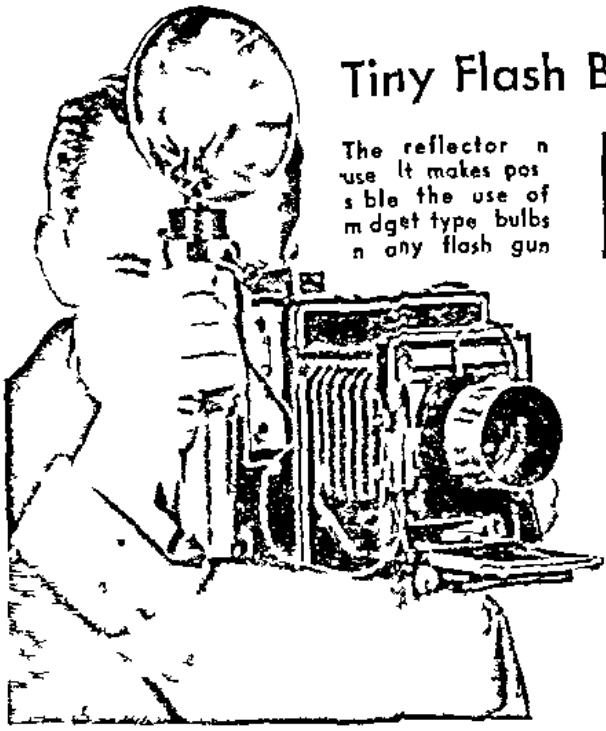
W th the v ewe n place a sl de can be stud ed w thout remov ng t from the book

Album Displays Transparencies

BY COMBINING the features of a slide viewer and an al bum a brand new accessory aids amateurs who make small size color transparencies Each page of the leather bound loose leaf album accommodates eight transparen cies The viewing device which may be stored in a pocket in the album cover consists of three hinged sec tions One forms the mirror another a translucent win dow which diffuses the light and the third a holder against which any page of transparencies can be placed for viewing without removal from the album

CAMERA FANS

Tiny Flash Bulbs Get New Reflector



The reflector in use It makes possible the use of midget type bulbs in any flash gun



DESIGNED especially for use with the new midget type photoflash bulbs a new reflector unit serves as a flash gun adapter As shown in the photograph immediately at the left the reflector is doubl having a central section curved to cast a fairly concentrated spot of light The remainder of the reflector is of the parabolic type and throws an additional pattern of light over a considerably larger area Extending from the base of the reflector is a neck with a standard size plug to fit any flash gun socket A bayonet type socket inside the reflector accommodates the midget peanut bulbs

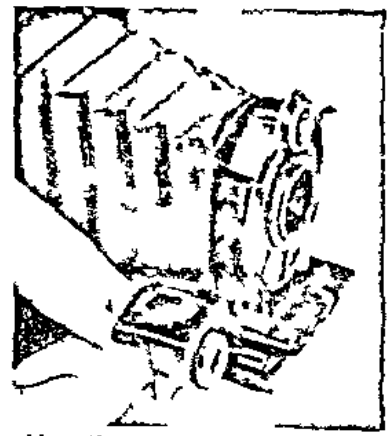
Thermometer Is Set in Hose

AS AN aid to getting exactly the right temperature in water used for photographic solutions a thermometer has been incorporated in a rubber hose The hose is attached to a combined hot and cold water faucet and the flow of water is regulated until the desired temperature is shown



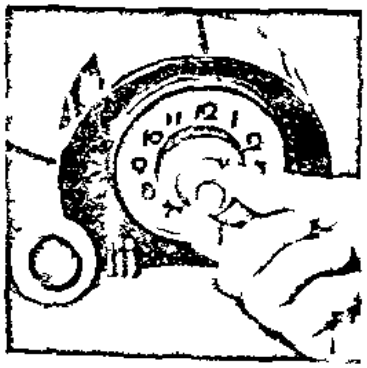
Handy Camera View Finder

WAIST LEVEL view finders that can be slipped in place on the front support of the camera are now available for users of folding cameras equipped only with eye level finders The lower viewpoint is often desirable especially in taking pictures of pets and children



How the waist level view finder mounts on the base of a camera

Dial Makes "Timer" of Any Clock



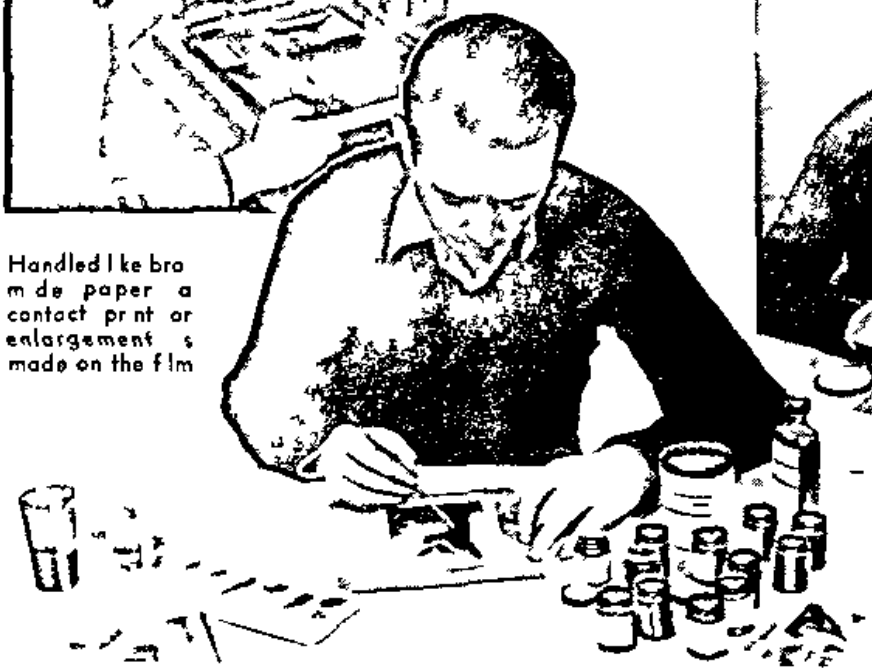
TURNING any clock into a darkroom timer a new dial can be attached or removed in a few seconds A suction cup holds it to the glass face cover of the timepiece By setting the dial in relation to the minute or second hand the user can determine by the dial's stop arrow the end of any desired exposure or development period.

New Photo Process Yields Color Prints

COLORED prints that are said to compare favorably with natural color photographs are made possible for the amateur by a new film material invented by Jack Crawford a New York artist Handled like bromide paper the film is used for making a contact print or enlargement Then it is bleached and tanned leaving a gelatine surface which absorbs dye in direct proportion to the exposure of the different parts of the film After the required dyes have been applied a white liquid paper is applied to its back



Handled like bromide paper a contact print or enlargement is made on the film





Water soluble dyes are applied after special treatment The dyes are absorbed in ratio to the lights and shades in the picture

Gutters for Darkroom Aprons

A DARKROOM apron with a trough around the bottom is a novel aid to preventing clothes and shoes from becoming stained by photographic chemicals The trough is produced by turning up the bottom of the lightweight rubberized apron and fastening it with metal buttons to catch stray drops of chemicals



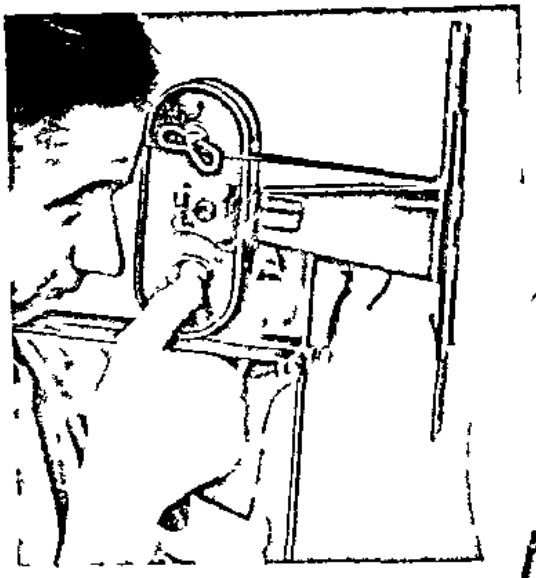
The folded up apron edge keeps liquids from dripping onto the clothes



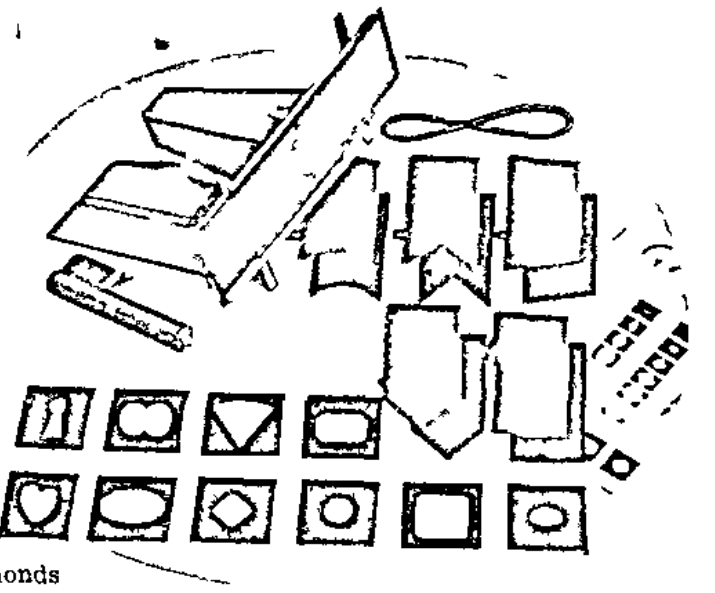
Cable Release Is Armored

ARMORED shutter release cables equipped with an outer covering of flexible metal offer increased resistance to wear With threads that fit standard shutters the new cables are available in various lengths even as long as 100 feet.

Framer Gives Home Movies a Professional Touch



Scenes can be framed in almost any shape with the framing outfit at the right The cut out masks are inserted in the boxlike lens attachment



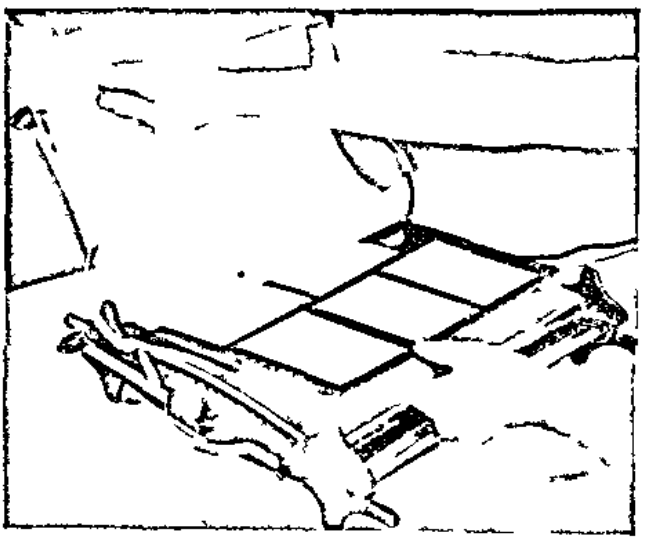
KEYHOLES hearts chevrons diamonds and binocular lenses are some of the wide variety of framing effects for motion picture scenes and titles obtainable with a framing unit now available Quickly attached to any eight or sixteen millimeter camera the unit utilizes a light-tight metal box fitted with a vibrationproof slide in which various metal masks may be inserted In addition the framer is equipped with eight variable irises for obtaining novel fade in and fade-out effects The iris attachments are directly adjustable by means of a finger control Light in weight, the framing unit may be used in either a vertical or a horizontal position

Easily Applied Fluid Hardens Negatives

NOW available to amateur photographers a liquid preparation protects negatives from scratches and finger marks, *keeps them pliable and prevents them* from curling Suitable for both still and motion-picture film the material permeates and becomes part of the emulsion, rendering it resistant to damage

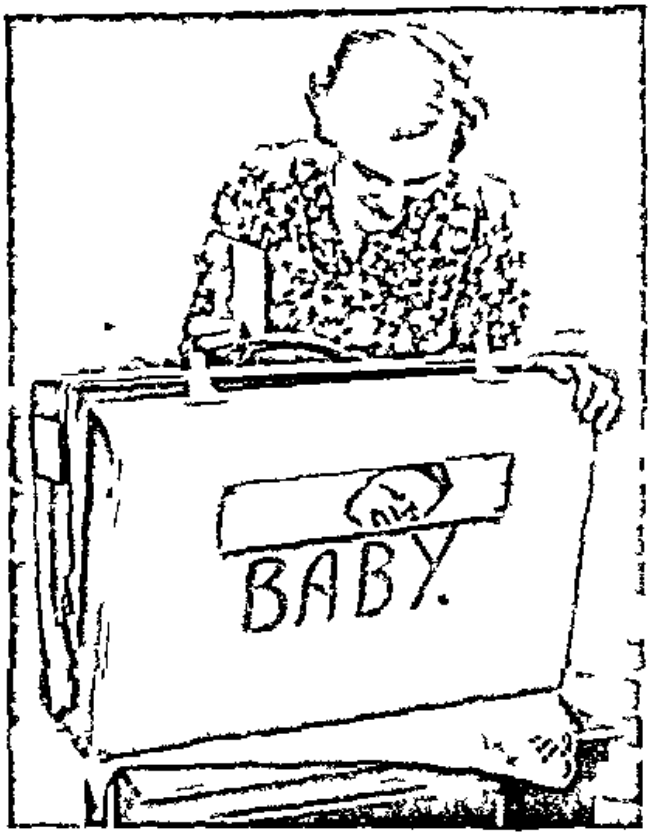


The liquid is simply wiped over the surface of the negative with a soft, lintless cloth



New Automatic Print Drier

ADJUSTABLE thermostatic control, automatic turn-off, and lintless canvas curtains are some of the outstanding *features of a* new electric print drier Accommodating two ten-by-four teen inch ferrotype plates, the unit may also be used for mat-surface drying The apparatus draws only 300 watts of electric current.



Suitcase Is Emergency Crib

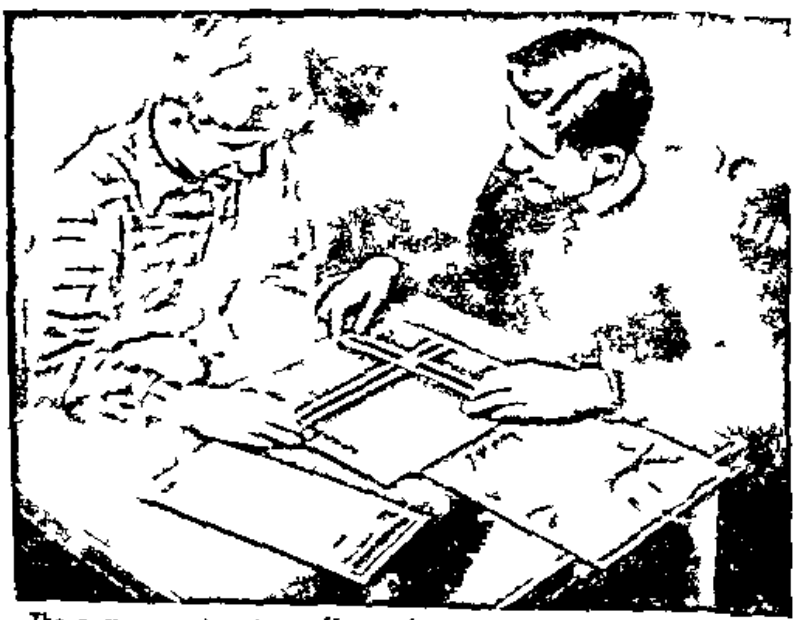
UNABLE to bring a baby's cot aboard a war refugee ship from the Mediterranean island of Malta an ingenious mother converted a suitcase into a combination bed and carriage for her four month old son The illustration above shows them packed for the trip with the baby watching the view through an improvised window A lettered sign insured careful handling of the crib

Electric Tool Cuts Door-Lock Mortises

IN A single operation requiring only a minute or so a new electric tool cuts a complete mortise for a door lock including recesses for both the lock barrel and face plate Splitting the wood is declared impossible, and the work is finished forty times as quickly as by hand Once a height rod has been adjusted the device is self locating



The machine in use It cuts a mortise for a door lock forty times faster than by hand

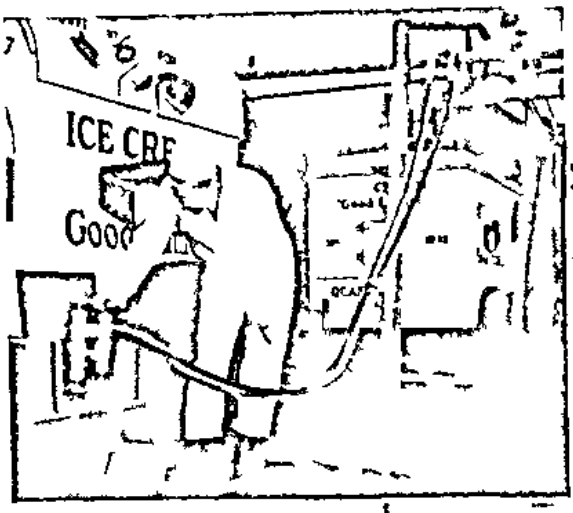


The game permits sixteen offense plays and as many for the defense

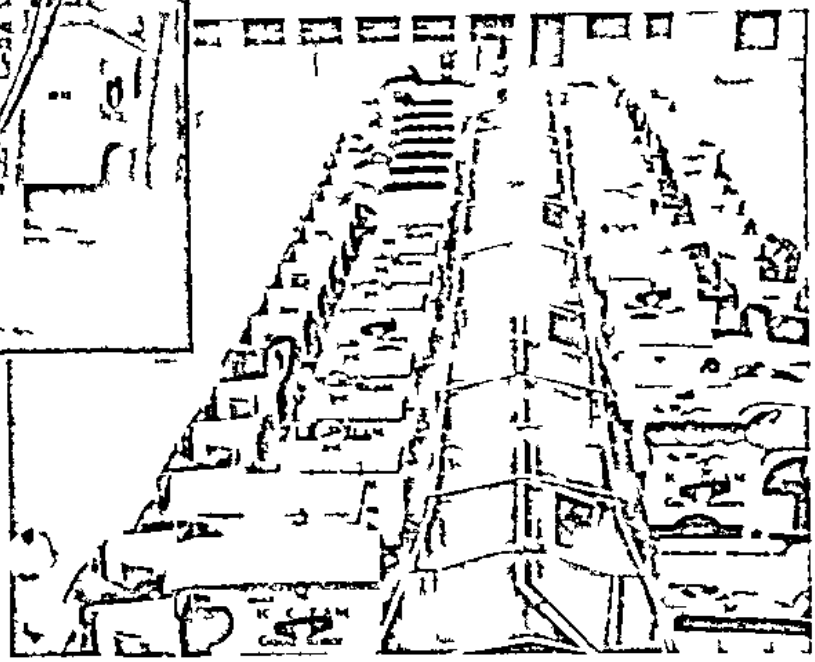
Quarterbacks Match Wits at Table Football

WOULD BE quarterbacks may match wits with a new indoor football game By moving a slide on a covered playing board the offense may secretly call for any one of sixteen plays At the same moment the defense moves a second slide to what he thinks the play will be Uncovering the board reveals yardage gained or lost Accessories keep track of the ball and the progress of the game

Pipes and Hoses Chill Ice-Cream Trucks



By means of hoses a ef g e ant s c culated th ough a t uck s cold compa tment

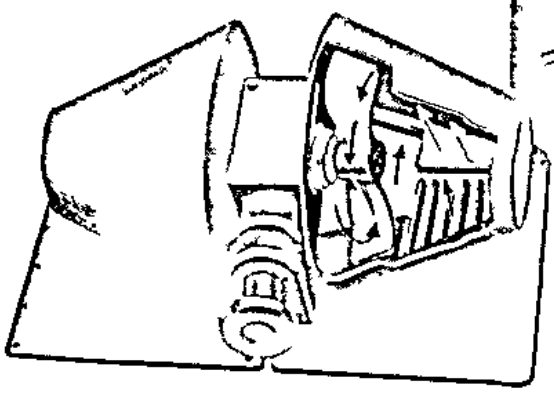


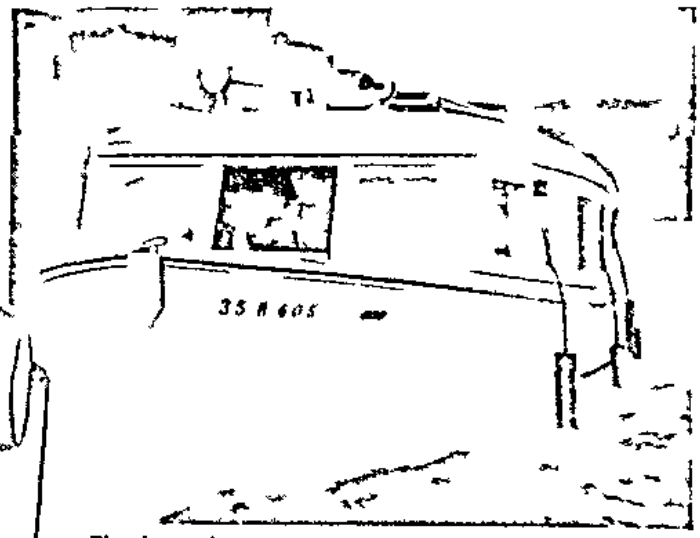
D t but ng fleet ned up along the p pe l ne fo ove n ght cool ng

LINED up o ern ght at a bank of refr gerat ng p pes outs de a Los An geles Cal f ice cream plant dozens of trucks are cooled at once Through pairs of rubber hoses and spec al coupl ngs the same refr gerant used in the factory circulates through each truck s cold compartment — a metal chamber insulated from heat by a secret compound resembling gelat n In the morn ng a mechanic disconnects the p pes and the trucks chilled sufficiently for all day service are ready to d stribute the com pany s product

Propellerless Boat Draws Little Water

REQUIRING l ttle more than a foot of wa ter a propellerless rotorboat has been created for a customer s Mississ ppi River jaunts by a veteran St. Paul M nn builder Its forty horsepo ver gasol ne en g ne operates tw n rotors inclosed in cones of th rty three inch max imum diameter Working much l ke the blow er part of a vacuum cleaner *the rotors dra › in water and expel* it through openings n the hull pro pell ng the boat forward or back ward accord ng to which way they revolve Intake grat ngs exclude weeds and debris In trial runs the $10 000 cru ser has shown an average speed of fifteen m les an hour

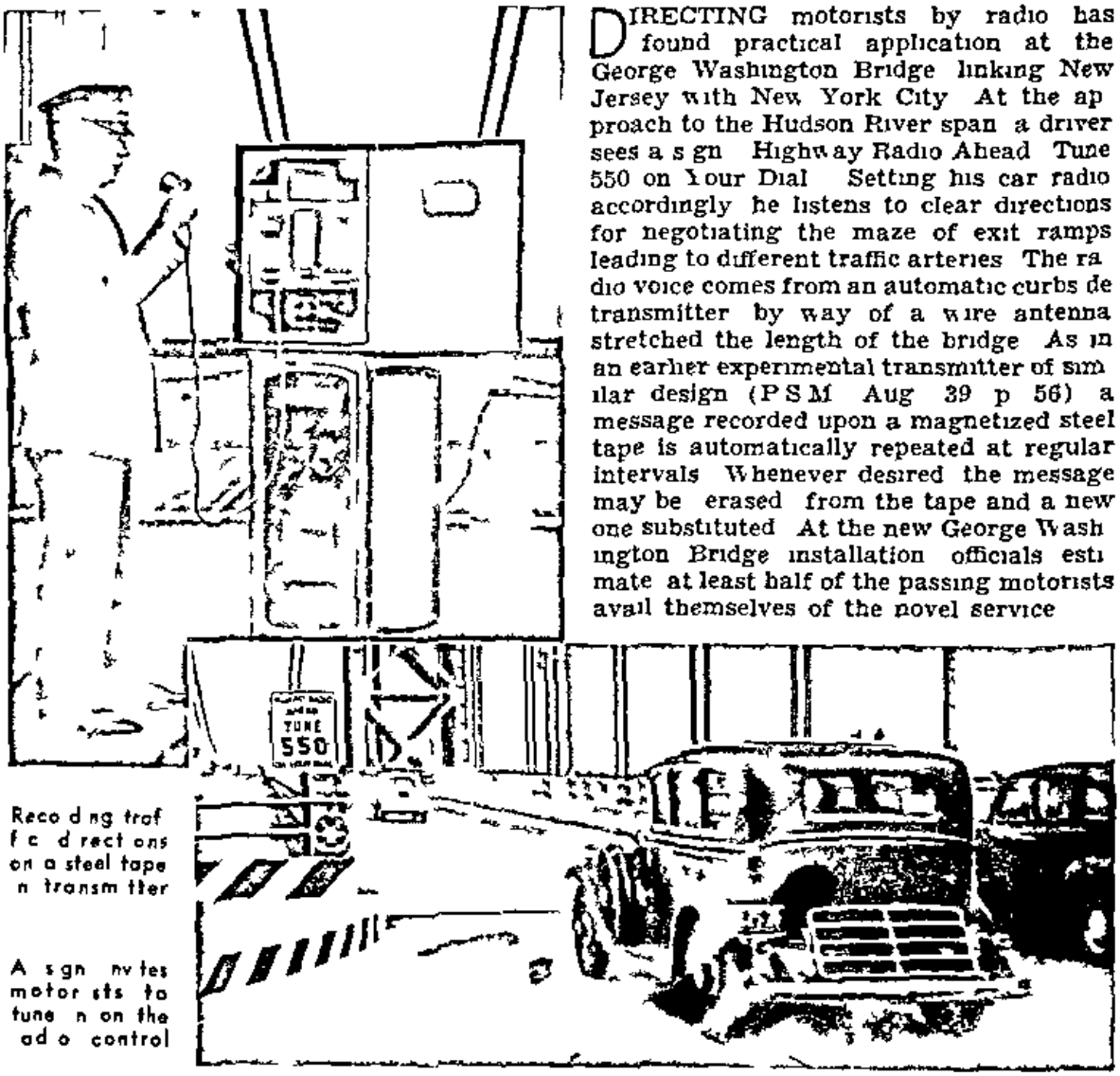




Thanks to the un que p opel ng mechan sm shown n the d aw ng at the left th s c u se can na gate M pp R ver wate s as l ttle as one foot deep

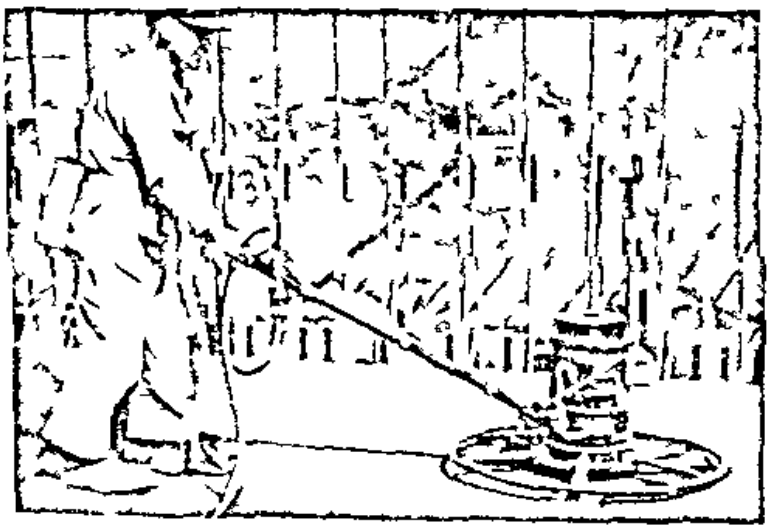
Bridge Traffic Is Controlled by Radio

DIRECTING motorists by radio has found practical application at the George Washington Bridge linking New Jersey with New York City At the approach to the Hudson River span a driver sees a sign Highway Radio Ahead Tune 550 on Your Dial Setting his car radio accordingly he listens to clear directions for negotiating the maze of exit ramps leading to different traffic arteries The radio voice comes from an automatic curbside transmitter by way of a wire antenna stretched the length of the bridge As in an earlier experimental transmitter of similar design (PSM Aug 39 p 56) a message recorded upon a magnetized steel tape is automatically repeated at regular intervals Whenever desired the message may be erased from the tape and a new one substituted At the new George Washington Bridge installation officials estimate at least half of the passing motorists avail themselves of the novel service



Recording traffic directions on a steel tape transmitter

A sign invites motorists to tune in on the radio control



Mechanical mason at work. An electric motor whirls the trowel blades

Rotary Trowels Quickly Smooth Cement Floors

THREE rotary trowels whirling 100 revolutions a minute in a new machine devised by a California inventor make short work of smoothing concrete flooring and pavement Powered by an electric motor the 300 pound device exerts much greater pressure than can be applied by hand permitting use of a mixture that will give a tougher and more uniform surface

Lamp for Typists Holds Manuscript

DESK LAMP and copy holder are combined in a new convenience for typists Wire clips hold in the light the pages to be transcribed while the lamp shade shields the typist s eyes as seen in the photograph at the right.



Clips on the lamp stand hold the pages to be transcribed

Oxygen Gives Diesels a Shot in the Arm

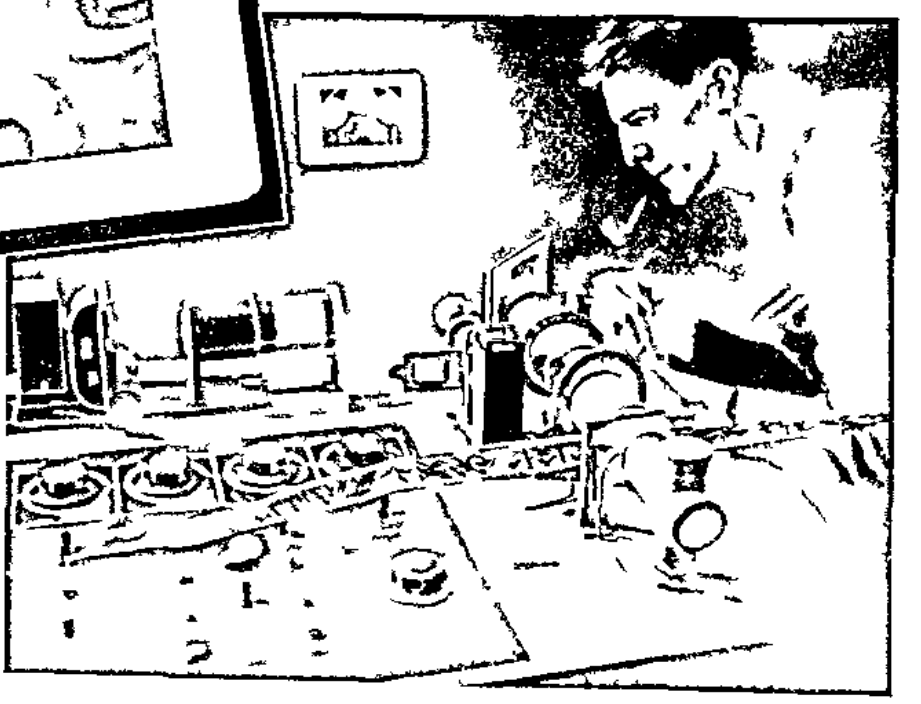
OXYGEN fed into the intake air of a Diesel engine increases its power output by fifty five percent for a few minutes without undue strain according to Prof Paul H Schweitzer of Pennsylvania State College who suggests that the method be used to stimulate Diesel airplane engines for the heavy load of taking off

Kaleidoscope Paints Television Screen

KALEIDOSCOPE pictures have gone on the air Just as musical selections fill interludes in sound broadcasting the eye pleasing patterns of light entertain lookers in between television features from the National Broadcasting Company s station W2XBS To transform a kaleidoscope from a child s plaything into a scientific novelty of 1940 engineers first photograph a simple design upon movie film The film then passes through a studio projector tube lined with mirrors which multiply the design eight times to produce a symmetrical image Two auxiliary projectors make a frame for the pictures, and superimpose any desired words or symbols upon the designs



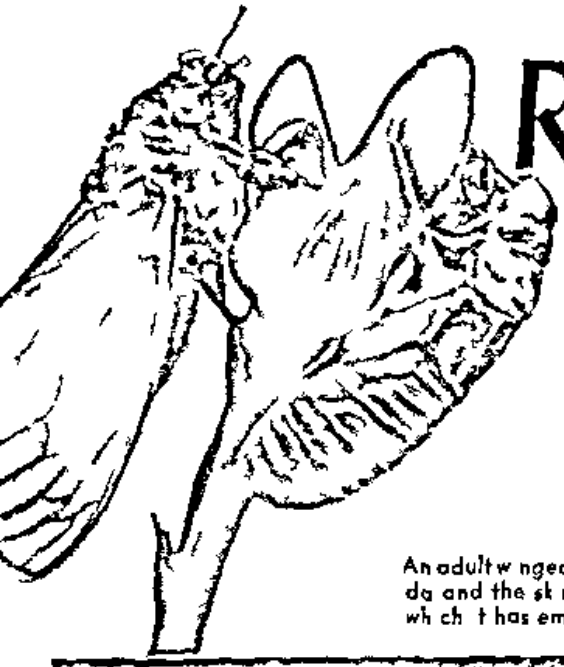
A kaleidoscope picture pattern as seen on the screen of the television receiver



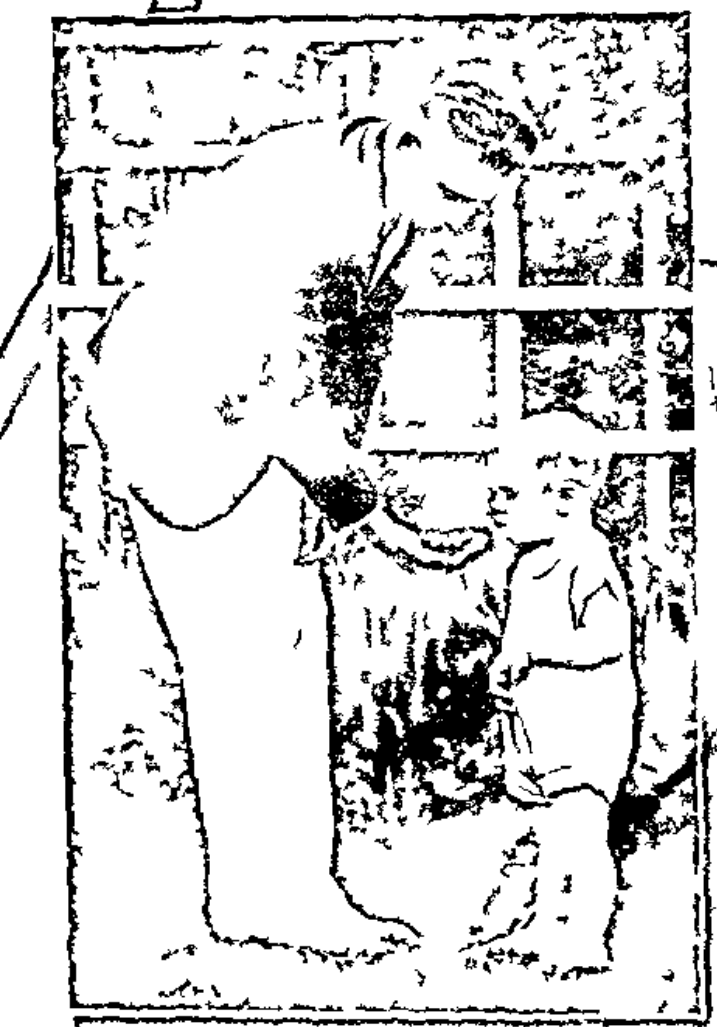
In the studio simple designs photographed on film are projected through a tube lined by mirrors

Return of the

Repeating Its Strange Cycle That Insect Rip Van Winkle, the Periodic Cicada, Again Enacts the Drama of Nature That Terrified the Pilgrims as a Plague and Omen of War



An adult winged cicada and the skin from which it has emerged



LOOK! BUG SHELLS! This two year old will be nineteen when the locusts come again. At right a cicada crawling out of its nymphal skin and the wing once believed to be an omen of war



By EDWIN TEALE

PHOTOS BY THE AUTHOR

Seventeen-Year Locust

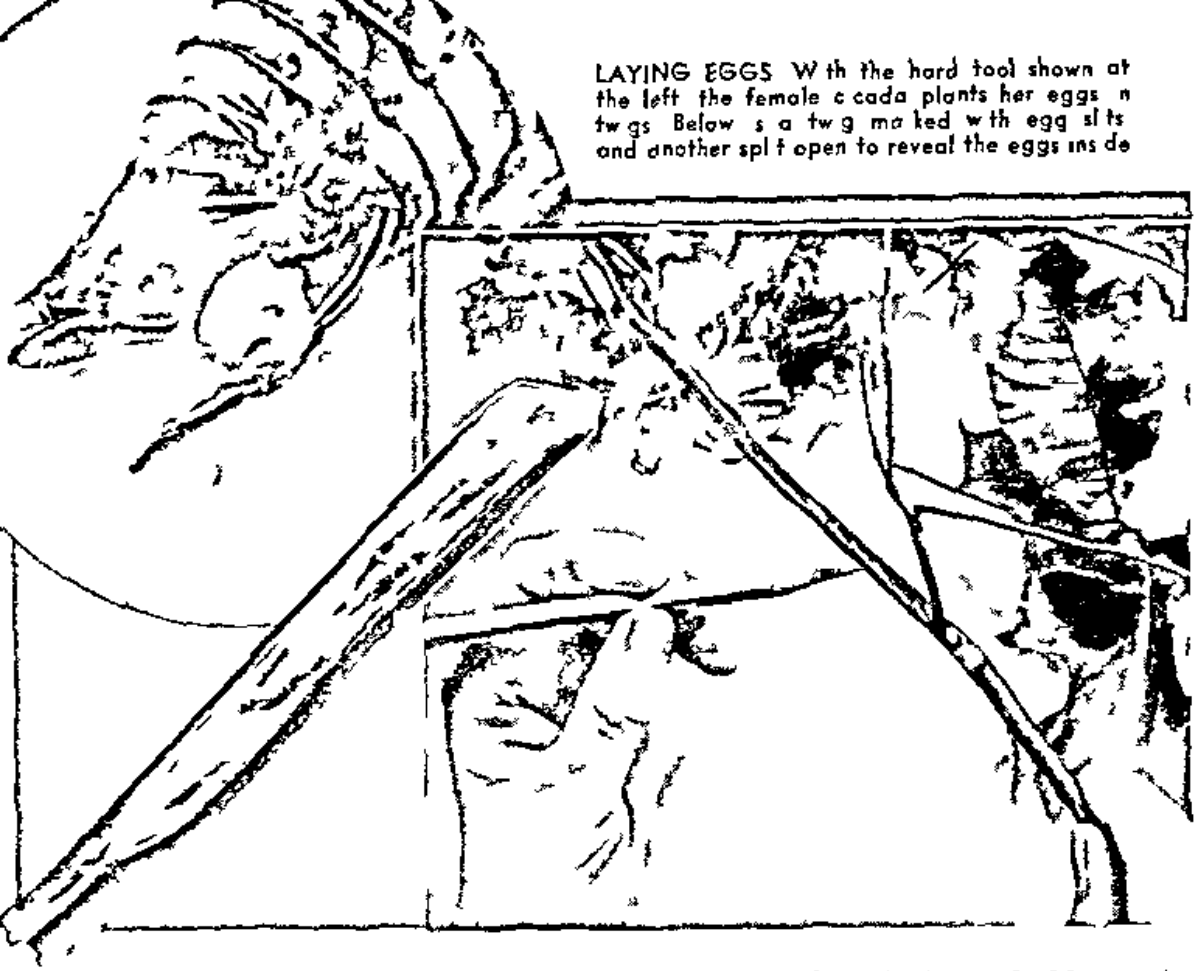
JUST 306 years ago the Pilgrim Fathers at Plymouth Mass were appalled at the sight of hundreds of thousands of winged and fiery eyed creatures crawling from the ground They mistook them for a plague of Biblical locusts and the superstitious noticing that the letter W was formed by the wing veins of the insects believed them an ominous warning of war

In recent weeks descendants of these identical creatures have reappeared in Eastern woods Once again from Illinois to the Atlantic seaboard from New England to Georgia one of Nature s strangest dramas—the return of the seventeen year locust or periodic cicada—has reached a climax. When that drama began in 1923 Harding was president flappers were in the headlines radio was just rising into popularity Like awakening Rip Van Winkles these insects now have emerged for a few short weeks of sunshine and open air after nearly two decades of darkness of sucking sap from rootlets of burrowing through the damp earth of an insect underworld

While this brief mating season was at its height I recently accompanied the noted cicada expert William T Davis of Staten Island N Y to a spot where the activity was greatest the Half Hollow Hills region of central Long Island Everywhere around us heavy bodied insects with reddish eyes and yellow veined wings were fluttering among the trees Riddling the ground at our feet were countless holes about the size of a 45 caliber bullet In some places they showed that the emerging insects had pushed their way up through gravel and even among small stones Their brown discarded skins clung to weeds twigs and bark or lay in little windrows among the tree roots Striking against the leaves the wings of the insect hosts produced a continuous sound like falling rain As we



This litter of empty skins indicates the vast numbers of the insects that appear at seventeen year intervals After their long imprisonment in the earth they emerge for a few weeks to mate and die



LAYING EGGS With the hard tool shown at the left the female cicada plants her eggs in twigs Below is a twig marked with egg slits and another split open to reveal the eggs inside

wound mile after mile along country roads a steady roar like breaking surf arose on either hand—the din of a million tiny insect drums being vibrated at once as male cicadas vied with each other in calling for mates

This remarkable sight has been witnessed by Davis probably more often than by any other living man. In 1877 when he was a boy of fifteen he saw it first Today at the age of seventy eight he still is a student of the cicadas Educational institutions and museums in many parts of the world send specimens to his laboratory for study and classification The importance of his work with cicadas has been given world wide recognition. Of the 170 species known to the United States he originally named and described more than 100

AS WE moved through woods echoing with the roar of the insect multitudes he told me something of the curious sound producing mechanism of the males It is a tiny drum formed of corrugated membrane located near the base of the wing No other insect in the world produces sound in a similar way and only the males possess the drums The females are silent. Davis has seen the females alight near the drumming males seemingly attracted by the sound He has also seen other males descend beside such soloists and in evident displeasure and jealous rage butt their rivals like goats

A curious thing in connection with the effect of certain sounds on cicadas was observed a few years ago by a scientist in Kansas. He noticed that the insects alighted in large numbers on tractors used in plowing The drumming of the engines apparently attracted them to the machines

Some relatives of our seventeen year cicada Davis told me use their drums to produce strange and alarming sound effects In the West for example there is a dark smoky winged insect that gives an almost exact imitation of the rattle of a rattle snake Collectors always have to be on their guard Many times they have peered into a bush from which they thought a cicada was calling and have found instead a coiled and buzzing snake

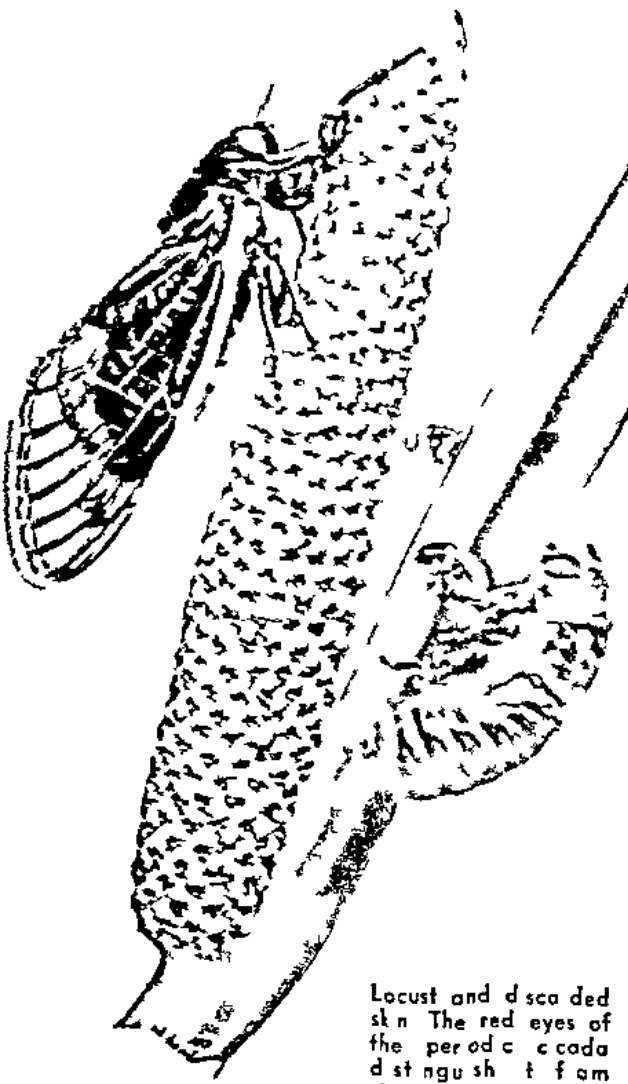
Among the vast array of specimens neatly pinned in wooden boxes that stand row on row in Davis s Staten Island laboratory are most of the strange cicadas of the world There is the biggest known an insect from Borneo with a seven inch wing spread and a body far larger than that of a humming bird There is also the tinest cicada a midget hardly half an inch long from Texas There are stop and go cicadas beautiful creatures from the rainy side of the Andes so called because they have bright red spots on the hind wings

and bright green ones on the fore wings There is one species with a jet black body and a strawberry red nose and another which is bright green and known locally in Australia as the Green Monday Probably the most curious of all the specimens is an Australian cicada with a hollow balloon like abdomen which acts as a sounding board to amplify the noise of the tiny drums

Several of the insects among the seventeen year cicadas and their relatives in Davis s collection were obtained under rather unusual circumstances There is one grayish brown desert cicada for instance which has been found only in automobiles The first two specimens to come to the attention of science—one arriving at Davis s laboratory and the other at Oxford University England—were both discovered in motor cars after tourists had driven through desert country in western states

In another case a friend of Davis s was traveling in a remote island of the Caribbean Sea when he heard cicadas in a wood land He made arrangements with a local taxi man to collect some of the insects and send them to Davis The man did such a good job that Davis showed his appreciation by naming one of the cicadas in his honor and publishing an account of it in a scientific bulletin Immediately afterwards the taxi man disappeared It developed that he was a fugitive from justice who had considered himself safe on the out of the way island Then by capturing a bug he had thrust himself into the limelight'

While many of the 2 000 different species of cicadas known to entomology have strange shapes and even stranger habits the most celebrated is still the seventeen year locust of our Eastern States As we watched the great hosts of these creatures in the woods of the Half Hollow Hills Davis told me a few of the it isn t so s about them In the first place they are not locusts but an entirely different kind of insect The Pilgrim Fathers called them locusts and the name has stuck in spite of entomology Again the statement found in many texts that periodic cicadas—like tobacco and wild turkeys—are native only to North America has been proved untrue *(Continued on page 232)*



Locust and d sca ded sk n The red eyes of the per od c c cada d st ngu sh t f am ts insect relat ves



Th s s the drum of corrugated membrane w th wh ch the mole c cada p oduces ts mat ng call It s located under the abdomen

Here's My Story



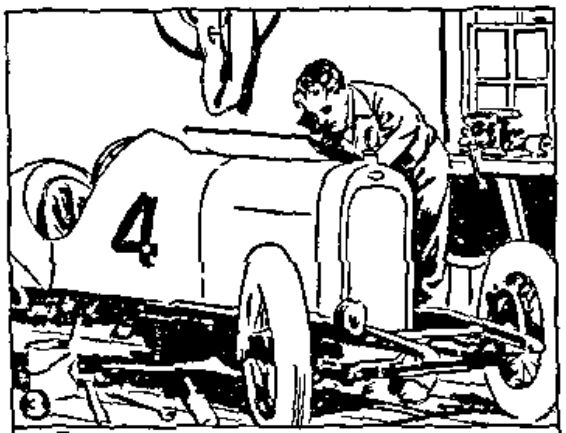
EDWARD V RICKENBACKER WAS BORN IN COLUMBUS, OHIO OCT 8, 1890



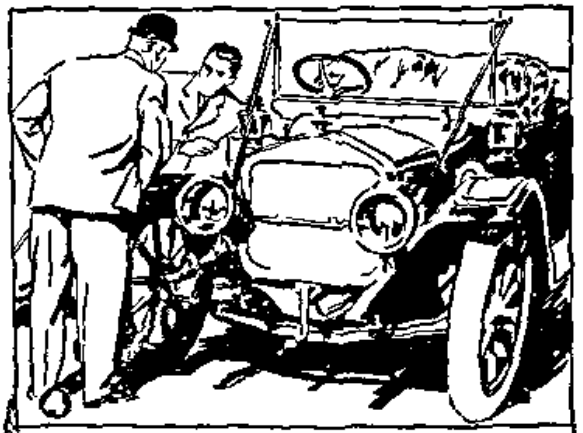
AFTER HIS FATHER D ED 12-YEAR-OLD EDDIE CLAIM NG HE WAS 14 GOT A N GHT JOB IN A GLASS FACTORY HE WORKED 12 HOURS A NIGHT FOR $3 50 A WEEK



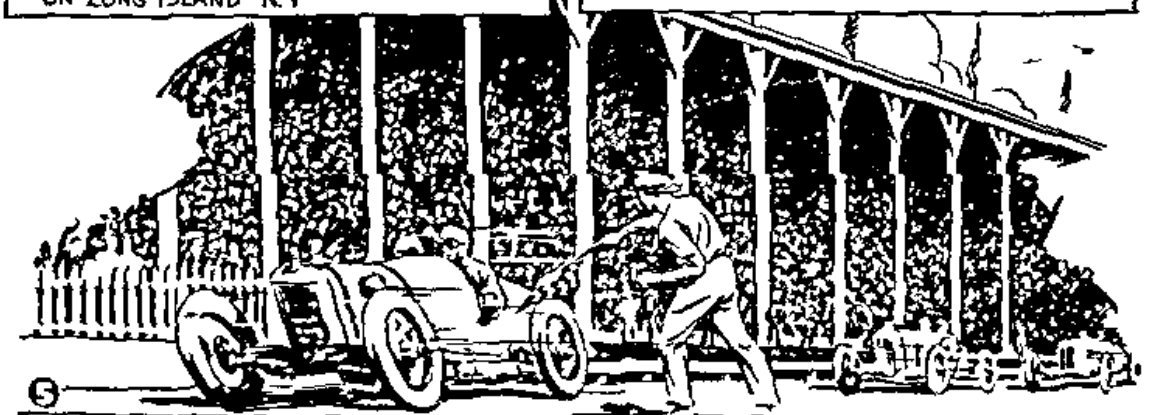
LATER DECIDING TO BECOME AN ENGINEER HE WENT TO NIGHT SCHOOL AND TOOK CORRESPONDENCE-SCHOOL COURSES FASCINATED BY AUTOMOBILES HE STARTED WORK WITHOUT SALARY SWEEPING FLOORS IN AN AUTO FACTORY



EDDIE SOON WORKED HIS WAY UP TO THE POST OF PERSONAL MECHANIC AND RACING ASSISTANT TO HIS BOSS LEE FRAYER WITH WHOM HE RODE IN VANDERBILT CUP RACES ON LONG ISLAND N.Y

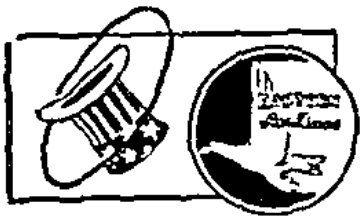


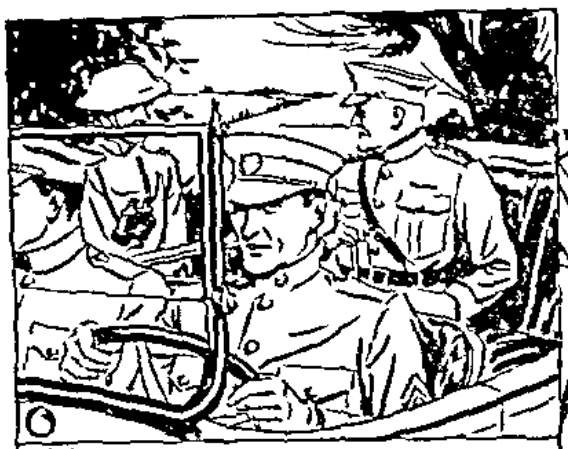
SHORTLY AFTERWARD HE BECAME AN AUTOMOBILE SALESMAN BECAUSE SPEED SOLD CARS IN THOSE DAYS RICK ENTERED ALL THE COUNTY FAIR AUTO RACES HE COULD



IN 1912 HE QUIT HIS JOB TO CONCENTRATE ON AUTOMOBILE RACING SOON HE WAS NATIONALLY FAMOUS AS A SPEED DEMON AT THE INDIANAPOLIS SPEEDWAY AND OTHER TRACKS

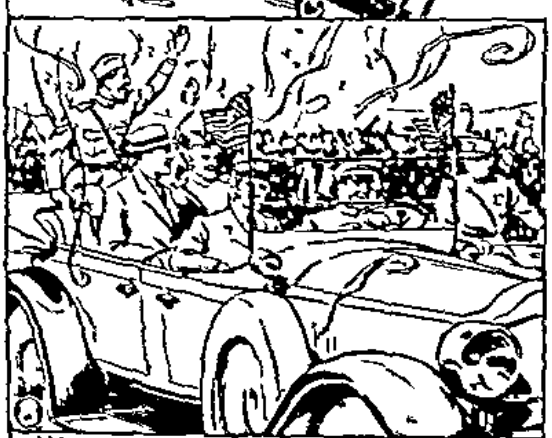
THE CAREER OF CAPT. EDDIE RICKENBACKER





WHEN THE U.S ENTERED THE FIRST WORLD WAR RICK WENT TO FRANCE AS CHAUFFEUR TO GENERAL PERSHING. HE SOON TRANSFERRED TO THE AIR CORPS LEARNED TO FLY AND TAUGHT H MSELF COMBAT TECHNIQUE

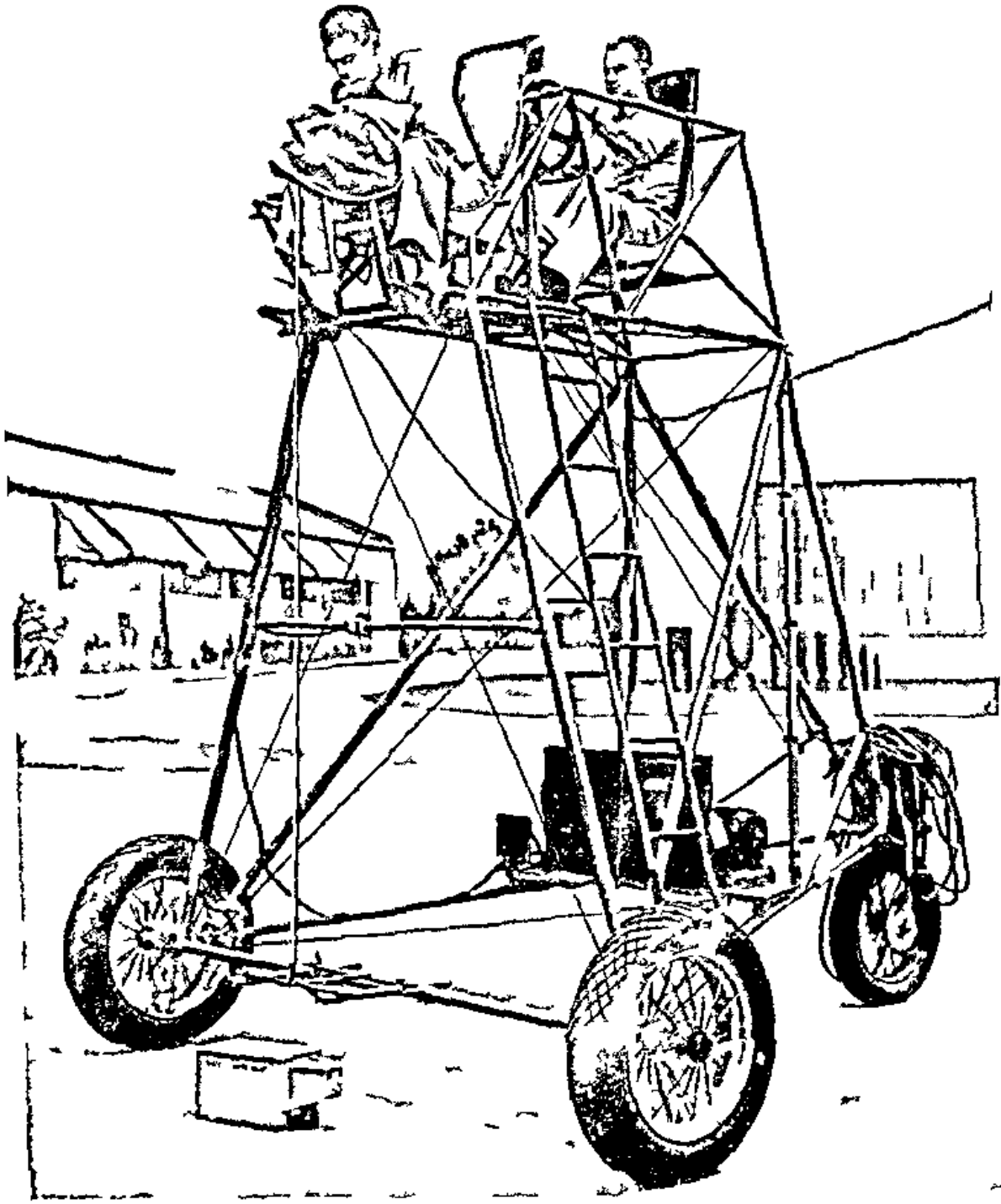
RICKENBACKER BECAME COMMANDER OF THE FAMOUS AMERICAN "HAT-IN THE-RING" SQUADRON AND WON HONORS AS AMERICAS GREATEST ACE SHOOTING DOWN 26 ENEMY PLANES. ONCE FLYING ALONE, HE ATTACKED SEVEN GERMAN PLANES DOWNED TWO, AND RETURNED TO HIS BASE UNSCATHED



WELCOMED HOME AS A NATIONAL HERO HE ORGANIZED THE RICKENBACKER MOTOR CO HE THEN WORKED FOR CADILLAC AS ASSISTANT SALES MANAGER OF THE LA SALLE D VISION



LATER RICK SWITCHED FROM THE AUTO TO THE AVIATION INDUSTRY HE NOW HEADS EASTERN AIRLINES AND THE INDIANAPOLIS MOTOR SPEEDWAY



"Tricycle" Trains Army Bombers

PERCHED on an odd three wheeled framework of metal tubing a U S Army pilot and his bombardier are pictured above at Rivers de Calif getting in some ground bombing practice with an electrical machine said to simulate actual bombing conditions A falling plumb bob plays the rôle of a bomb Note that the bomb sight a closely guarded Air Corps secret since it is reputed to be the most accurate in the world is covered with a hood to hide it from the prying eye of the camera.



Joseph Rost ck r ght consult ng h s p lot before a fl ght

Flying Dock Master Spots Ships by Air

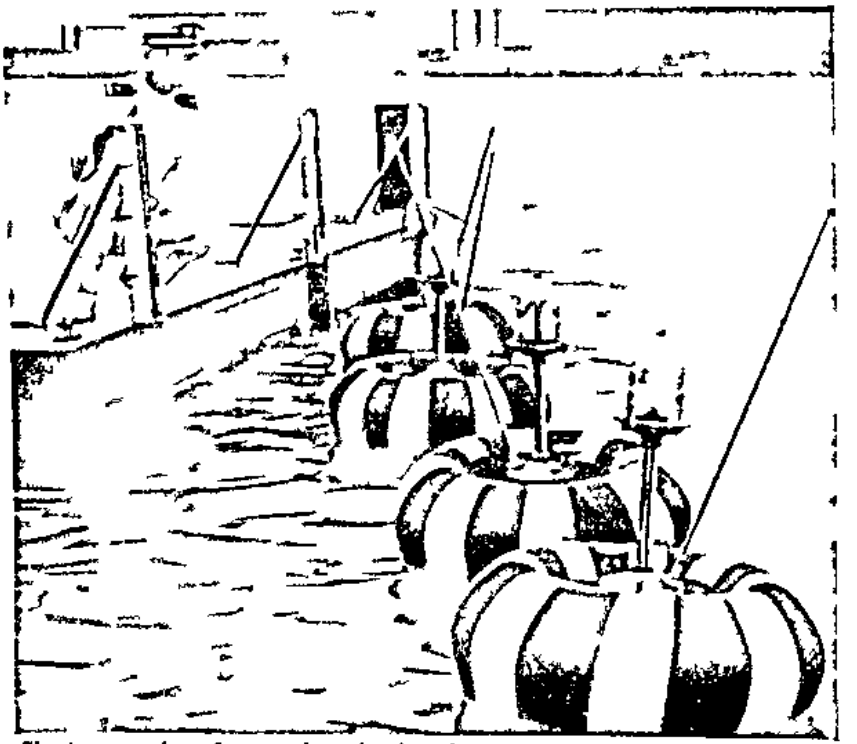
COVERING his beat by air saves untold time and trouble for Joseph Rostick New York dock master whose duty is to collect wharfage fees from transient boats using city owned facilities Piloted in a light plane along miles of waterfront he readily spots new arrivals tied up at the piers Thus he finds out just where to pay his calls when he gets back to earth without wasting time hunting his customers

Quinine Cures Fever in Airplanes, Too

QUININE long a medical stand by for combating high fevers has a similar value in aviation accord ing to researches made recently in the laboratories of the Standard Oil Company at Cleveland Ohio It was found that small quantities of the drug added to lubricating oil keep the oil from decomposing at the high temperatures produced in airplane engines

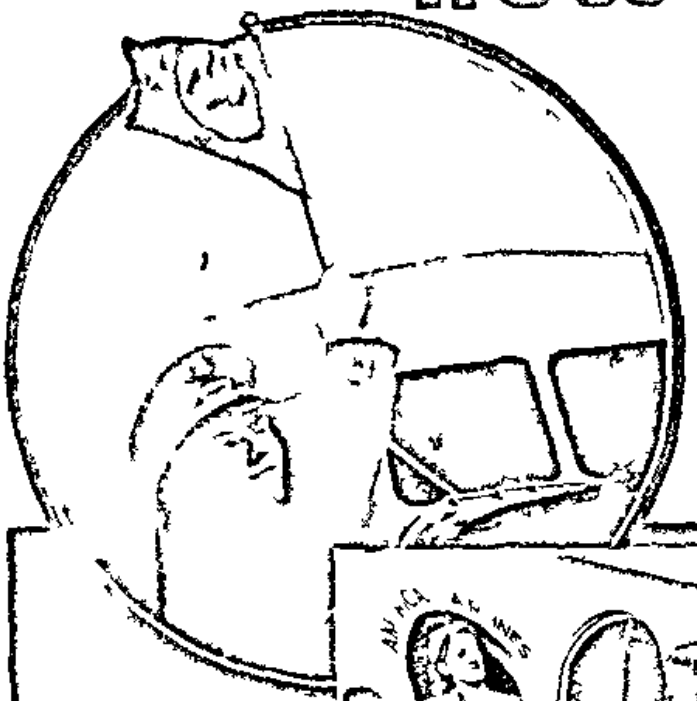
Radio Controls Seaplane Landing Buoys

TURNED on and off by radio control new lamps on air filled rub ber floats will outline safe landing lanes for aircraft in U S har bors Green lights mark the entrance to the aquatic runway yellow lights are spaced along its 5 000 foot length and red lights show its end Powered by dry cells the lamps are of the new fluorescent type in which glowing chem icals provide the illu mination Their dough nut shaped floats bear black and yellow stripes for daytime visibility The softly inflated floats are no hazard to wa ter craft and tests have shown that they are not easily damaged by collisions



Float ng ma ke s for seaplane land ng lanes Note rad o cont ol antennas

HOW AIRLINE



SCUDDING across a broad black runway at the world's largest airport in New York City an American Airlines transport wings into the air on a 1 000 mile non stop flight. Up in the cockpit a seasoned transport captain veteran of hundreds of aerial voyages guides the plane westward Beside him his assistant called

First Officer Hatch pulls in the flag Below he is seen with his fellow students Dugan and McCormick arriving at LaGuard a Field for training



Edwin Hadley Hatch

THREE typical airline pilots—one from the U S Army one an experienced commercial pilot and the third from the U S Navy

EDWIN HATCH came to the airline school from the Army Air Corps After graduating from the Advanced Flying School at Kelly Field Tex in 1939 he remained in the Army until January 1940

WHEN he was a junior in high school W W McCormick learned to fly In 1933 he was selected to accompany Admiral Richard E Byrd to Little America as an autogiro pilot On his return he served as a flying instructor and after 2 000 hours of commercial flying decided to enter training as an airline pilot



W W McCormick

BORN in Memphis Tenn in 1914 Edward Dugan joined the U S Navy in 1935 He received flight training at Miami and at the Pensacola Fla Naval Air Station and then served on the *Pensacola* and the aircraft carrier *Ranger* He entered the pilot school in January 1940



Edward J Dugan

CAPTAINS ARE MADE

the first officer is off on his initial flight as a member of the plane crew starting a transport career that will lead him to a $9 000 a year job as captain of a flying flagship

What does it take to make an airline captain? How does a candidate qualify for the job? How is he trained for a post where he will be entrusted with the air safety of twenty one passengers and a $120 000 plane?

American Airlines selects its pilots at a rate now approaching one a day from three main sources commercial military and naval aviation A prospective first officer must have a commercial license with at least 1 000 hours of flying *or its equivalent in* Army or Navy air experience He must be a citizen of the United States and not more than thirty two He must have perfect health a pleasing personality and a real love for the job

Of the three budding first officers whose training



1 Newly arrived the training classmen take a look at one of the big flagships they soon hope to be able to fly An instructor is pointing to a direction finding antenna

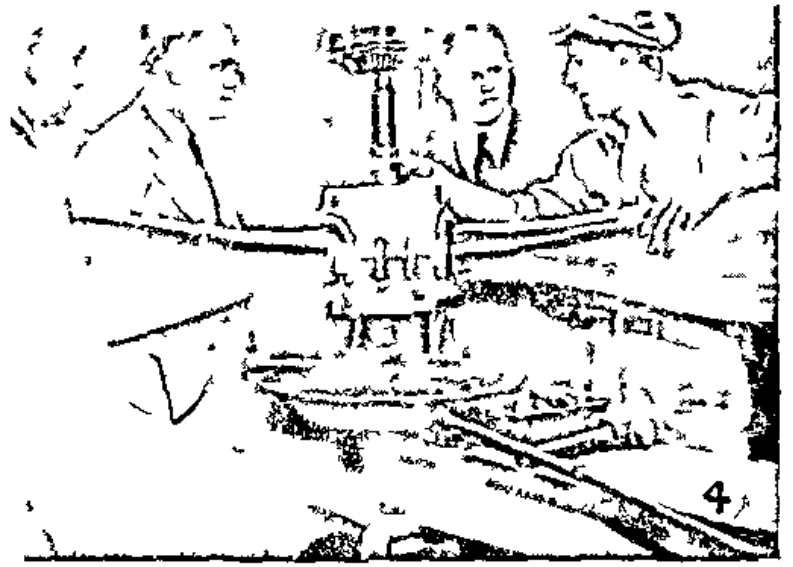
2 Old fashioned classroom examinations reveal the would be pilots technical knowledge of flying In the background is the Link trainer used in blind flying tests

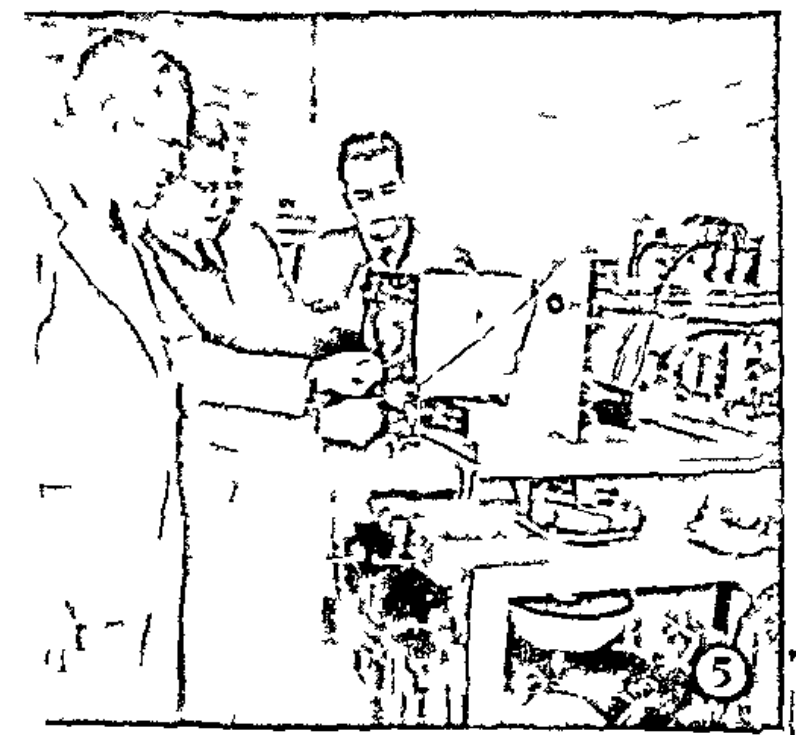
3 Accepted for enrollment the three students draw their books for study The stacks of manuals and instruction sheets will require many hours of burning midnight oil

career is followed in the accompanying photographs one came from the Army Air Corps one from duty aboard a Navy aircraft carrier and one from commercial flying on the Pacific coast All three passed their physical examinations with flying colors and started their training together in American Airlines pilot training school in Hangar 1 at the airline headquarters LaGuardia Field New York City

Because the trio like all other candidates for flagship berths were already accomplished flyers their training was designed primarily to familiarize them with airline procedures and the handling of the giant twelve ton Douglas twin motor transport planes Their first schooling consisted of a series of lectures given by veteran pilots and specialists on subjects that ranged from meteorology radio and navigation to civil air regulations and general airline operations

By observation and actual work in the huge maintenance and repair shops of the airline they learned about the operation and upkeep of all parts of their planes—hydraulic landing gear batteries fuel heating and venti







4 Practical knowledge is quite as important as theory Here Dugan McCormick and Hatch are being shown the workings of the controllable pitch propeller by an American Airlines mechanic

5 On a tour through the shops at LaGuardia Field the trio of young pilots examines a plane radio receiver being overhauled They familiarize themselves with the ground service organization

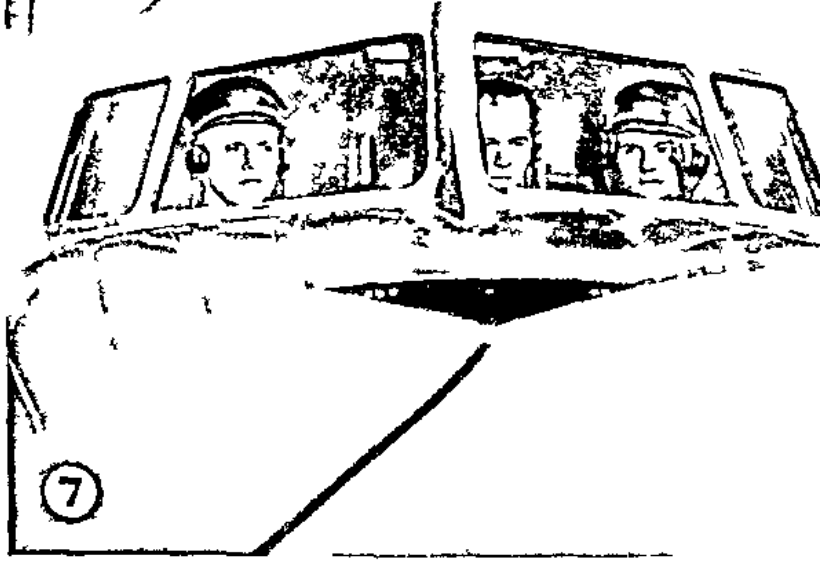
6 In the pilots lounge Hangar No 1 they do their homework It takes plenty of hard work to satisfy the airline officials that a young man is qualified to skipper one of the big flagships

lating systems engines and propellers

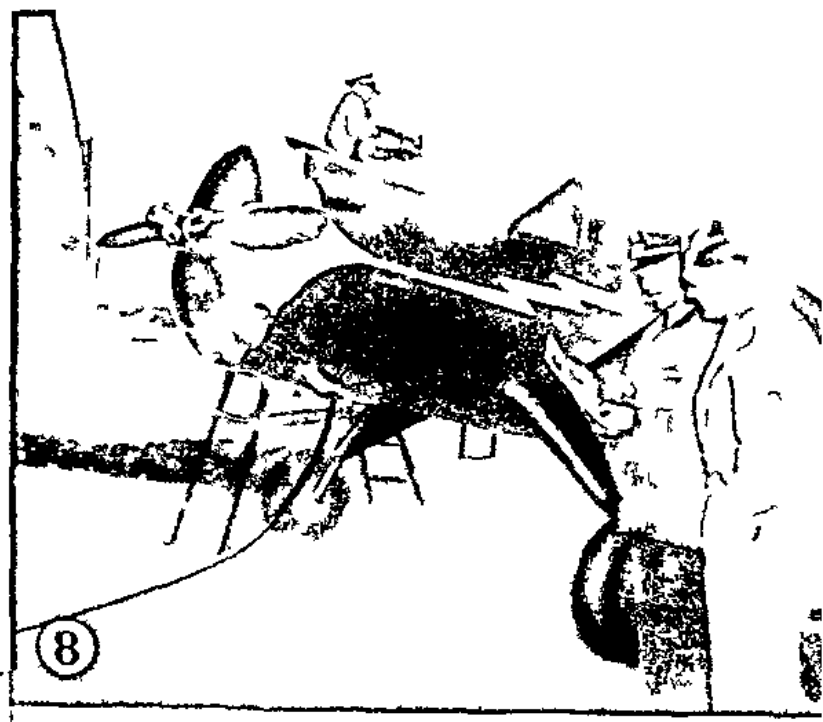
In the school headquarters they spent long hours under the hood of one of the school s two Link trainers practicing navigation instrument read ing location and meaning of radio beam signals and test approaches to various fly ing fields Each time they emerged from their station ary flights in the Link an instructor pointed out their mistakes as recorded by the automatic device that traces every movement of the im aginary flight

Their first actual flying as student officers came in the company s Stinson trainer planes Here the fledgling captains practiced instru ment flying in the curtain shrouded cockpit From this they progressed to flights in the transport planes and finally to fifty hours of line checks flights in regularly scheduled planes as a third member of the sh p s crew

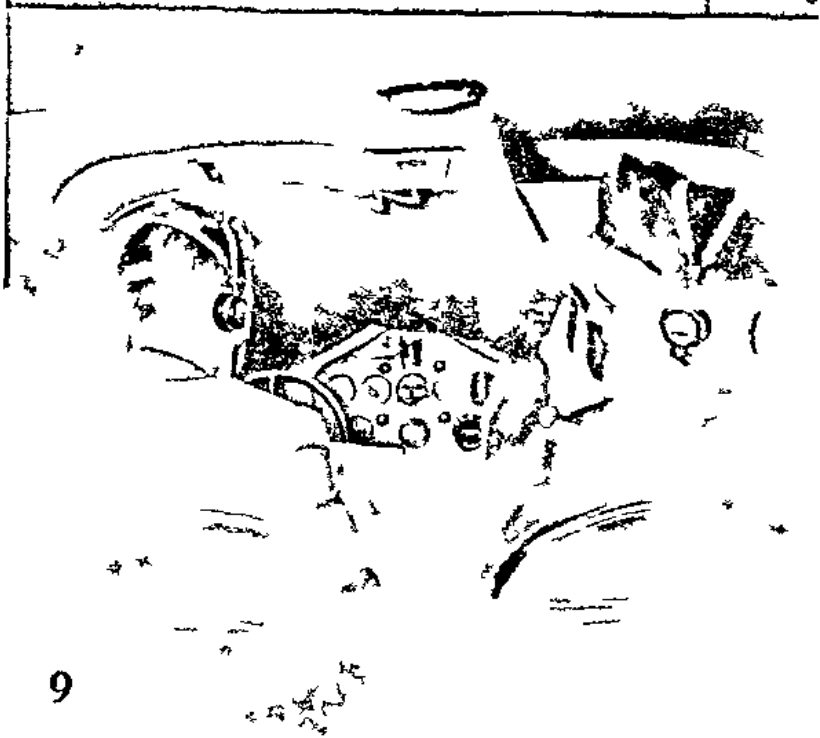
From this two month pe riod of intensive training the students finally emerged as first officers started to earn their monthly salary of $190 Their pay will be increased twenty dollars every six months until it reaches $350 when they should be ready for appointment as captains



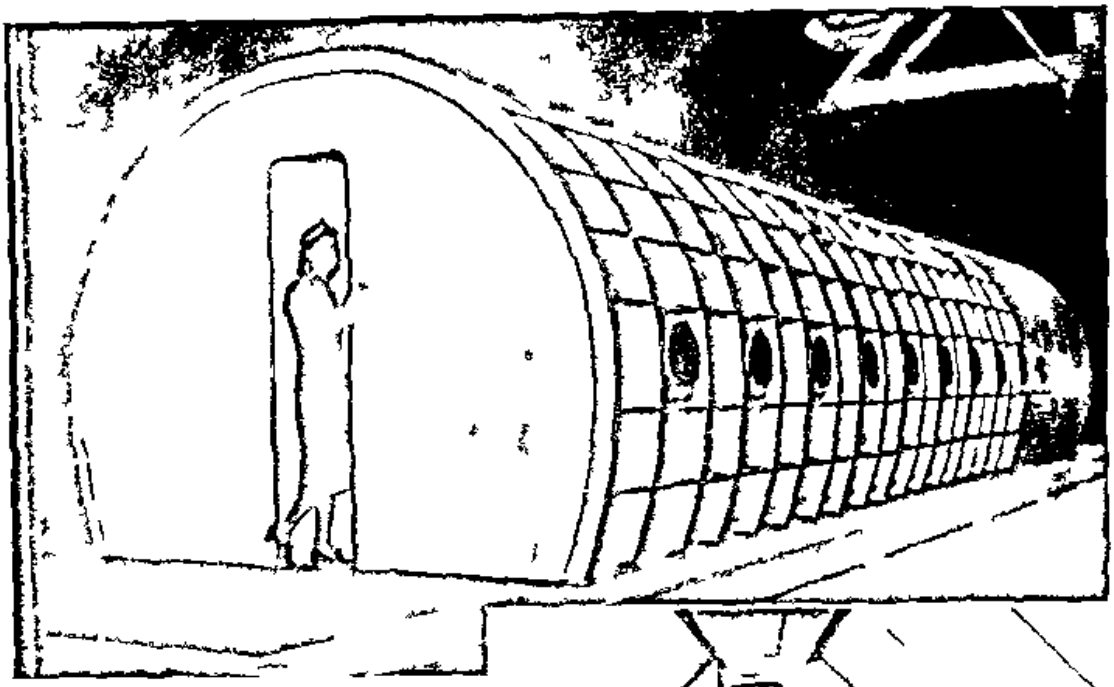
7 W th an exper enced p lot to coach them they cl mb nto the cockp t of a Douglas DC 3 for a pract ce fl ght Soon they w ll know the compl cated rout ne of fly ng one of these b g a l ners



8 Student Hatch n un fo m s ready to take off n a St nson t a n ng plane for a bl nd fly ng test After prov ng h s sk ll n th s smaller sh p he w ll go on to the regula t ansport c aft



9 W th a black hood cove ng the t a n ng plane s w ndsh eld so that he cannot see out Hatch p epares to take off fly and land w th only h s nstruments and rad o s gnals to gu de h m



Air Hostesses Train in Dummy Cabin

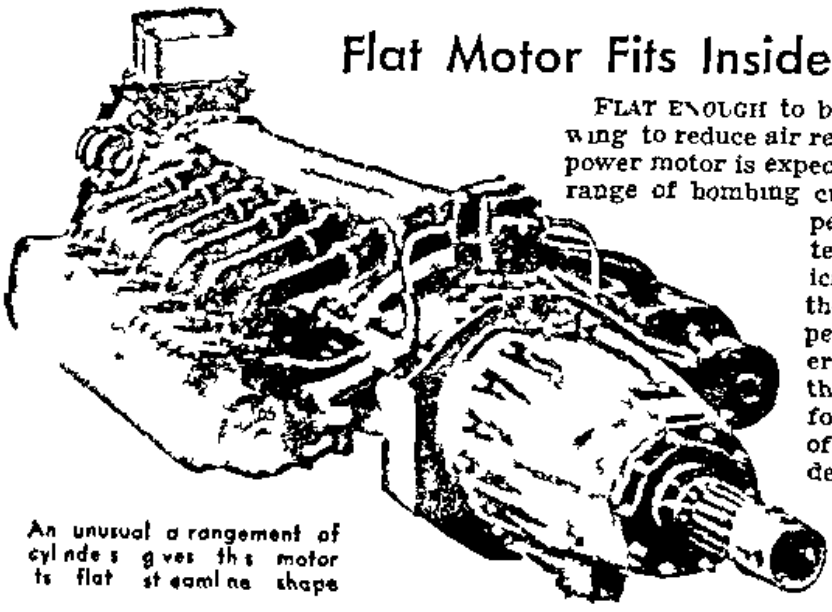
A BARREL-SHAPED full size du pl cate of an airliner s cabin serves as a schoolroom for United Air Lines hostesses It also helps in planning interior fittings for giant forty passenger planes that the company will put in operation next year Built at Burbank Calif the $10 000 wooden model measures sixty feet long—the length of an actual fuselage minus the pilots compartment and the tail section



Hostess chats w th passengers n the s xty foot model of a transport plane cab n In the exter or v ew above the door at the end co responds to the open ng from the p lots cockp t

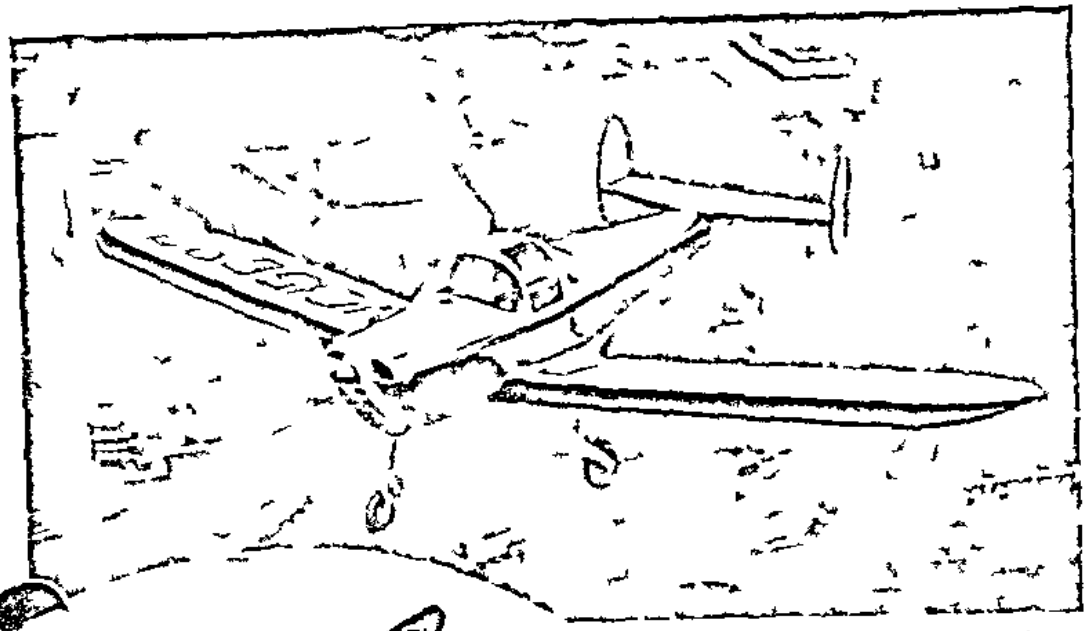
Flat Motor Fits Inside Plane's Wing

FLAT ENOUGH to be placed inside an airplane w ing to reduce air resistance a new 1 200 horse power motor is expected to increase the cru sing range of bombing craft by as much as fifteen percent and their speed by ten percent A leading Amer ican maker collaborated with the U S Army Air Corps to perfect the liquid cooled pow er plant which measures only thirty seven inches high by forty four inches wide Six of the engine s twelve cylin ders are mounted on each s de of the crankcase as shown at left The motor weighs slightly over a pound for each horsepower unit

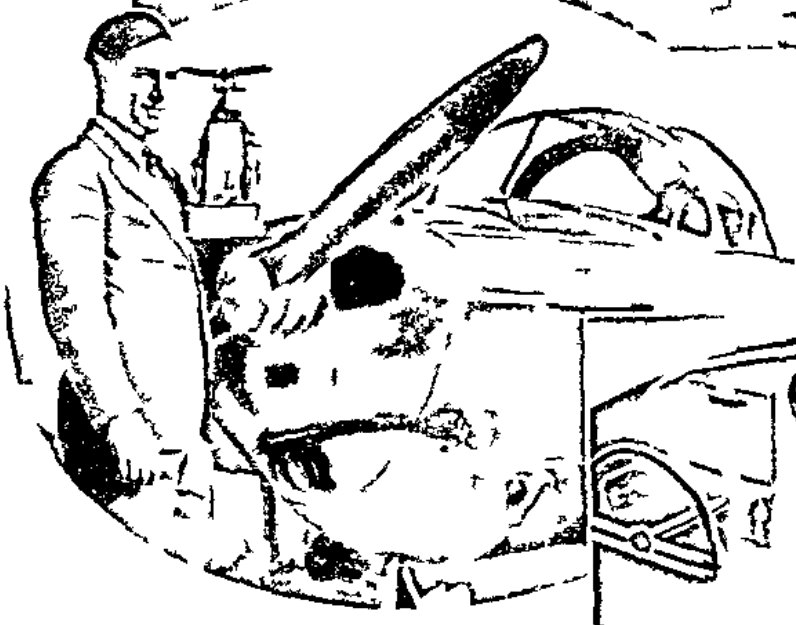


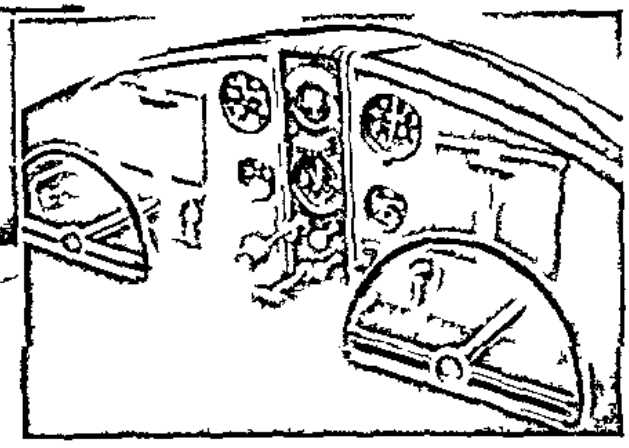
An unusual a rangement of cyl nde s g ves th s motor ts flat st eaml ne shape

"Owl Plane" Can't Spin or Stall



The new l ght plane in fl ght over Wash ngton D C Left L eut Robert Sanders w th a trophy he won in the owl faced craft Photo below the cockp t w th dual wheels of the s mpl f ed controls

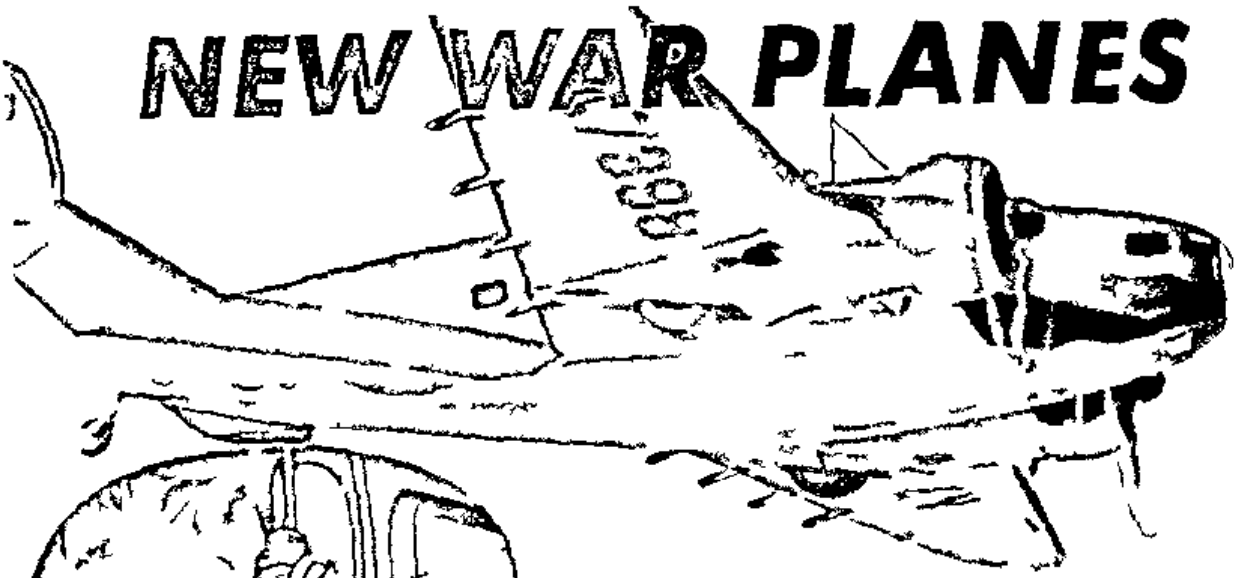




AN OWL-FACED plane of new design said to be incapable of spinning or stalling combines a variety of attractive features for private flyers Handled like the wheel of a car a control wheel steers the all metal craft by operating its rudder and ailerons simultaneously On the ground the same control turns a nose wheel for taxiing Transparent panels give all around and overhead vision for take offs and landings and for keeping out of the way of other planes in the air A tricycle landing gear and special air cushioned shock absorbers help to set down the two seater machine gently Hydraulic wheel brakes bring it to a full stop within 200 feet so that any small field may serve as a landing place

According to the maker the new plane flies twenty six miles on a gallon of gas and a fuel capacity of fourteen gallons gives it a 350 mile cruising range Its sixty five horsepower motor propels it at a cruising speed of 105 miles an hour and a top speed of 117 miles an hour Sturdy and powerful enough to be flown safely in weather that would keep many light planes grounded the new model is said to have flying characteristics that cause it to be little affected by winds of as high velocity as fifty miles an hour

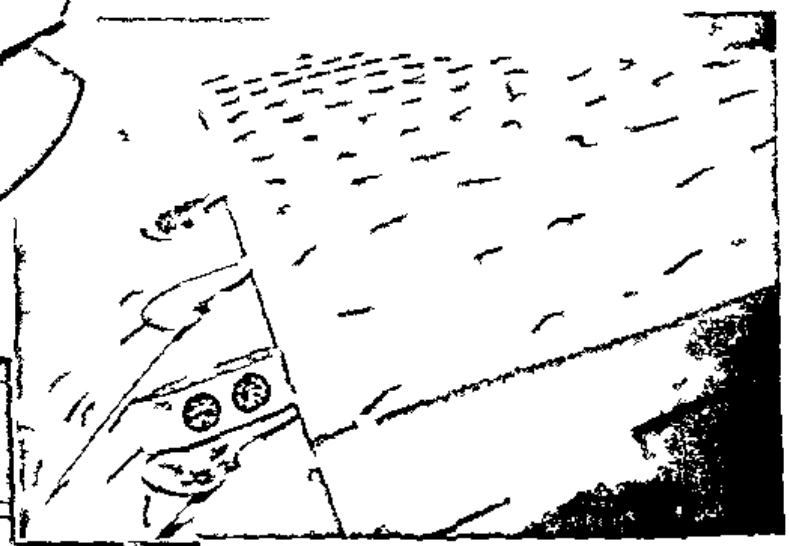
NEW WAR PLANES



A fast econna s ance bambe —one of the many wa planes be ng put th ough the paces n test fl ghts

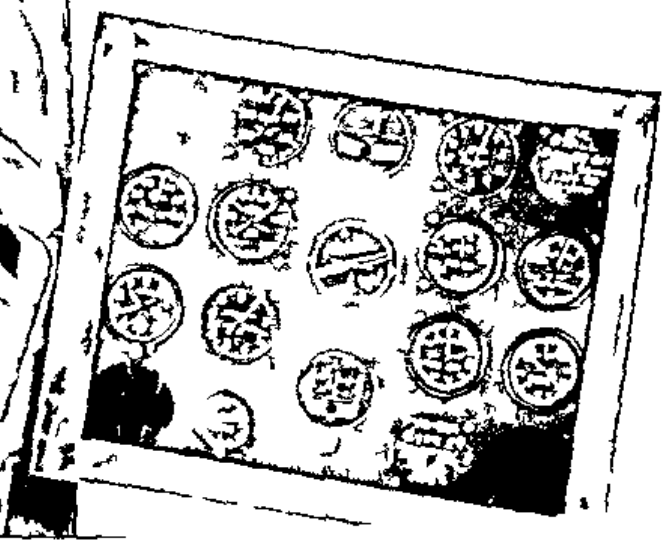


Mo an p ct es of b t of ya n glued to the w ng as at ght show the a f ow du ng a sta l





In the boxl ke tunnel n the cab n of the plane at left photog aphs a e taken of a panel co ry ng mo e than a dozen n t u ments that show the react ons of the sh p to fl ght maneuve s w th wheels t aps and athe pa ts n va ous test po t ons



GET THIRD DEGREE

MOVIE CAMERAS bits of colored yarn and a bomblike instrument lowered on a cable have been helping to check the maneuvering and landing performance of newly completed warplanes at an aircraft plant near Burbank Calif

Aloft on a test flight the pilot Milo Burcham tries stalling a swift ship with power on and then off landing wheels up and down and wing flaps in various stages of extension

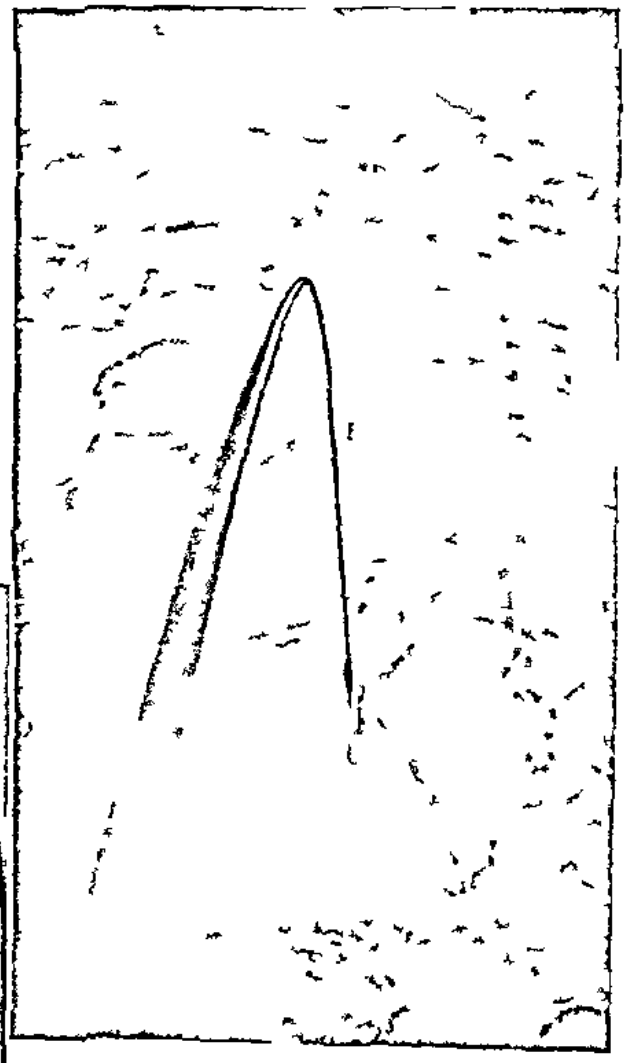
Meanwhile the flight engineer R. L. Thoren takes movies of fourteen instruments housed in a miniature tunnel and illuminated by powerful lamps These repeater dials duplicate the readings of standard dials on the plane's instrument board Resulting photos show simultaneously the plane's speed the angles of its ailerons positions of rudders and elevators outside air temperature direction of flight and time to the second

At the same time an assistant operates a sixteen millimeter movie camera bolted firmly to a steel post in the cabin and trained through a window on one wing He photographs an air speed meter a clock and the antics of seventy eight short streamers of tinted yarn attached with glue to the upper wing surface If the plane noses upward into a perfect stall the strings nearest to the ship's fuselage acting as tiny weather vanes are the first to reveal eddies and shifting movements of air flowing over the wing Gradually the turbulence moves toward the wing tip and finally reaches the aileron thus showing that lateral control is being maintained as long as possible

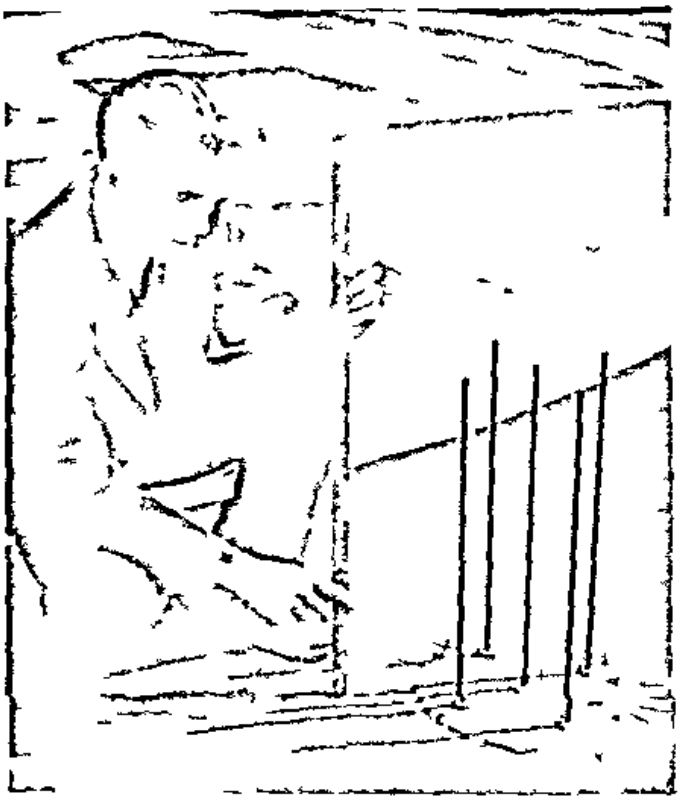
To measure the secret top speed of the plane an additional meter is lowered through a door Shaped like a bomb it points directly into the air stream no matter how the plane turns

After a flight engineers analyze the speed figures and the two sets of movies If the dials or pieces of yarn have revealed any shortcomings necessary changes are made to correct them





Top air speed—a closely guarded secret—is determined by a sensitive indicator in a bomblike device that is put out from the door of the cabin on a long cable The bomb always points directly into the flow of air



The yardstick shows the size of the new radio range antenna

Plane Radio Beacon, Like a Lighthouse, Has Rotating Beam

SWEEPING completely around the horizon at the rate of sixty times each second a new radio range beacon constantly shows a plane pilot whether he is flying toward the beacon or at an angle to it Perfected by the Radio Corporation of America the new system uses a tiny ground antenna consisting of five metal rods only two feet long and ten inches apart set up as shown at the left. Previous systems have required towering antennas that present a flying hazard In addition to the revolving beam the system sends out a brief signal in all directions just as the narrow revolving beam points north Responding to the two signals, a hand on a dial on the plane's instrument panel gives a continuous reading of the angle between the direction to the transmitter and the direction the plane is flying

Supercharged Ignition for Airplanes

BECAUSE air within the shielding of the ignition cables of airplane engines becomes contaminated by moisture and combustion gases permitting ignition leaks and speeding corrosion Carl E Swanson an airline electrical engineer developed an ignition supercharging system that forces thoroughly filtered air through the cables Air to the cables is forced through a flask containing filtering chemicals which last about a week in average commercial planes The new system already has stood the test of 1 500 000 miles of flying

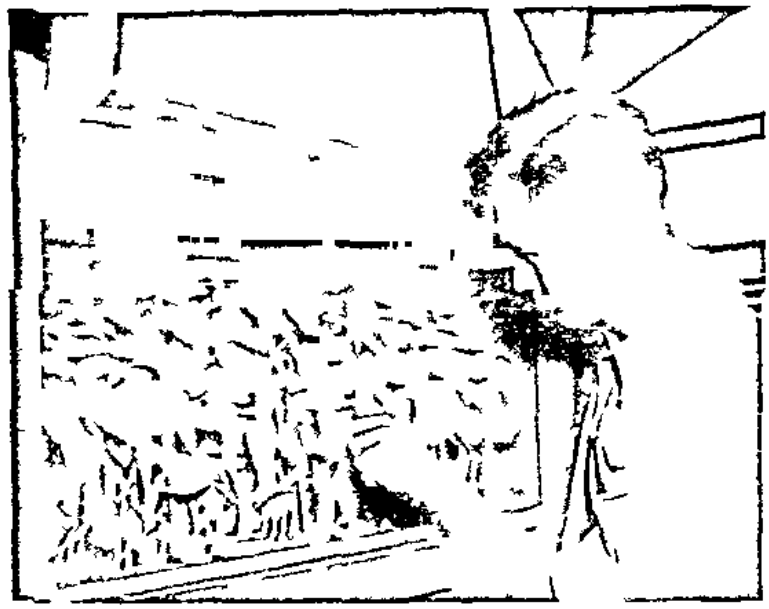




Filtered air forced into the ignition cable shields stops contamination Note the tiny filter jar right

He Breeds Bugs To Aid Science

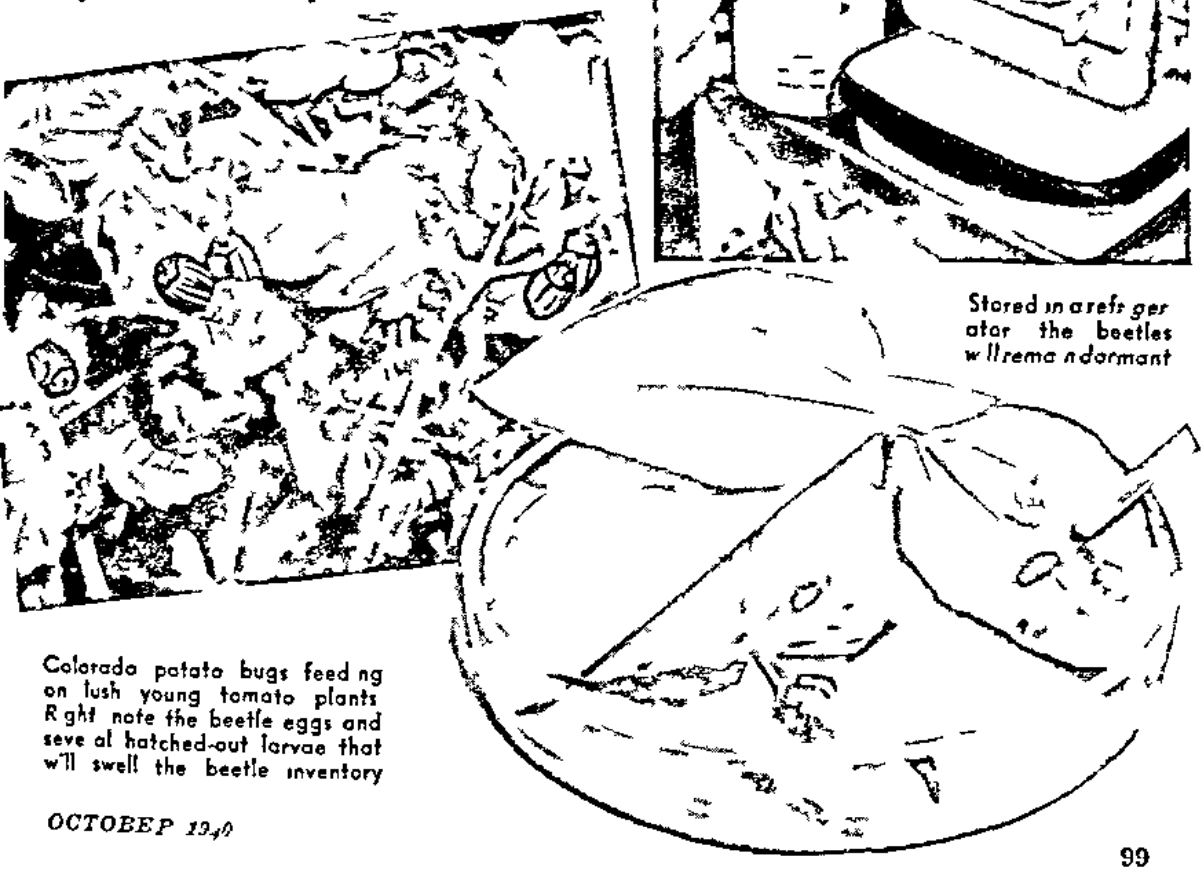
A STRICT diet of every *thing they* like and plenty of it is the good fortune of the guests of a boarding house for insects conducted as a spare time business by James Brann of Poslyn N Y The bugs have little to complain about— until Brann ships them off in batches running as high as 5 000 at a time to scientific research laboratories all over the country Bean beetles and Colorado potato beetles make up the bulk of the live stock in this novel bug ranch Since they are voracious eat ers a careful watch is kept to see that they are well sup plied with the plant leaves that they naturally prefer In each large screened cage sprigs of the preferred leaves are regularly replaced Breeding is accelerated or halted by scientific control of the air in which the insects live At eighty five degrees F and a high relative humidity they breed rapidly but when packed in mailing tubes and stored in a refrigerator they become virtually *dormant.*



James Brann with a batch of his care fully bred beetles



Stored in a refrig erator the beetles will remain dormant



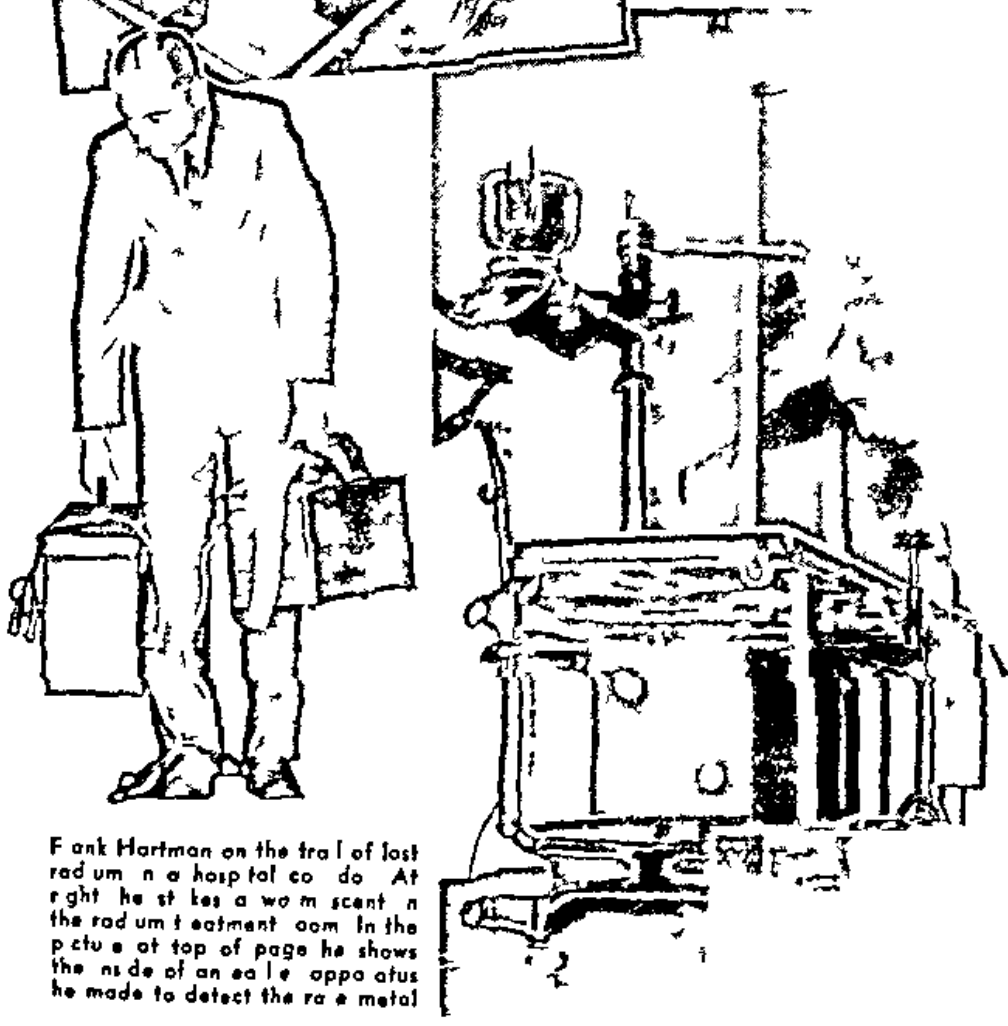
Colorado potato bugs feed ng on lush young tomato plants Right note the beetle eggs and seve al hatched-out larvae that will swell the beetle inventory

Radium Detective Uses



RECOVERING lost radium with the aid of a homemade electric bloodhound that g ves off a musical note instead of a bark when it nears its quarry is the odd avocation of Frank Hartman of Philadelphia Pa In the past five years Hartman and h s apparatus—which was constructed largely of spare radio parts—have recovered nearly $80 000 worth of the precious rad oact ve substance after it had been lost or misplaced in hos pitals in and near Philadelphia

At first glance the case that houses the apparatus resembles a carpenter s tool box With n are radio p ck up tubes an amplifier a power pack and an electrical bell and gong Batteries are carried in a second case Rays given off by the rad um cause the delicate mechanism to sound the bell or gong Or ginally Hartman used a loud speaker the disturbance caused by



F ank Hartman on the tra l of lost rad um n a hosp tal co do At r ght he st kes a wo m scent n the rad um t eatment oom In the p ctu e at top of page he shows the ns de of an ea l e oppa atus he made to detect the ra e metal

Electric Bloodhound

radium rays being amplified into a crackling like radio static This noise proved disturbing to hospital patients however so the musical chime was substituted For outdoor work the bell replaces this gong In either case the telltale sound announces that radium is close at hand the frequency of the sound increasing as the apparatus is brought closer and closer

In a number of instances Hartman has tracked down radium after it had gone through hospital incinerators The radioactive substance cannot be destroyed by fire so it remained unchanged in the ashes taken from the furnace The difficulty lay in discovering which shovelful of ashes contained the radium In some instances Hartman has had to shovel tons of waste material before the rapid fire sounding of the bell announced he had brought his quarry to bay

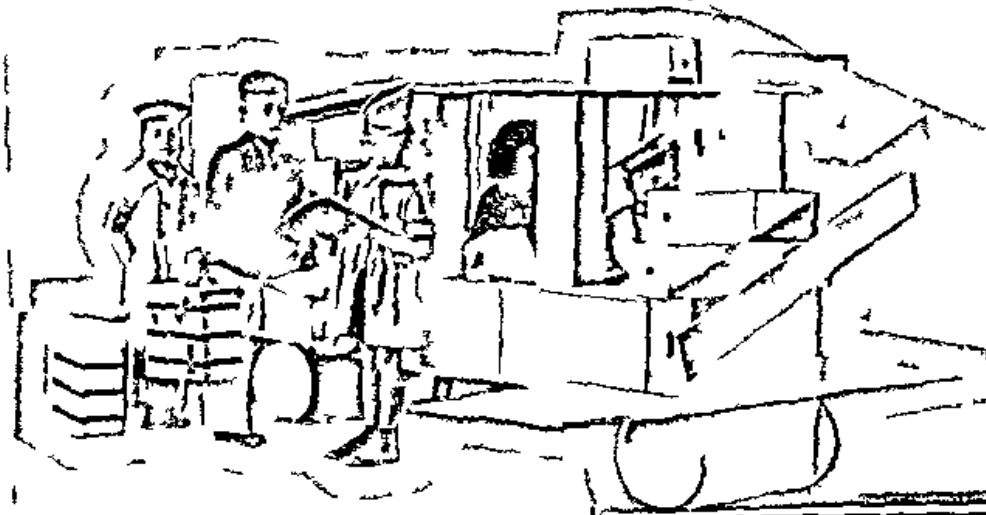
Sometimes the lost radium is discovered in hospital corridors at other times in waste material on its way to the incinerator and occasionally in the flaming furnace itself In the latter case the ashes are sifted as soon as they have cooled In only four of forty three attempts has Hartman failed to find the radium he sought So sensitive is his homemade device that it will begin to sound its signal when it is as far as 500 feet from the radioactive metal and will track down quantities as tiny as one five thousandth of a gram



Hunting a radium needle in an incinerator haystack When the precious material is brought close to the detecting device a gong rings In the upper picture Hartman picks out the lost radium container with a pair of tweezers It is seen in the circle—$600 saved from the ashes

FROM PLAY JOBS

By ANDREW R. BOONE



Elementa y sc ool students at Burbank Cal f play at a r t anspo t n a plane they bu lt f om blocks and boxes R ght un o h gh school boys use maps and re co d ng nstruments to study the weather



IN A schoolroom at Burbank Calif seven year old youngsters build a dummy transport plane One of the boys occupies the pilot s cab n a little girl stands at the door taking tickets and others play the parts of passengers Near by junior h gh school students re bu ld in m n ature the Lockheed Aircraft Company s ma n plant while others con struct a map showing Southern Cali fornia s mounta ns and airports In Los Angeles boys and girls of high school age and older engage in fifty one trades at the Frank Wiggins Trade School put ting on the finish ng touches which pre pare them to take real jobs in industry

From kindergarten to graduation in dustrial education in the Southwest fol lows a new pattern these days In the lower grades youngsters are encouraged to learn all they can about principal local industries If the town boasts an aircraft plant or air port they vis t the scene and reproduce with cardboard and blocks what they see

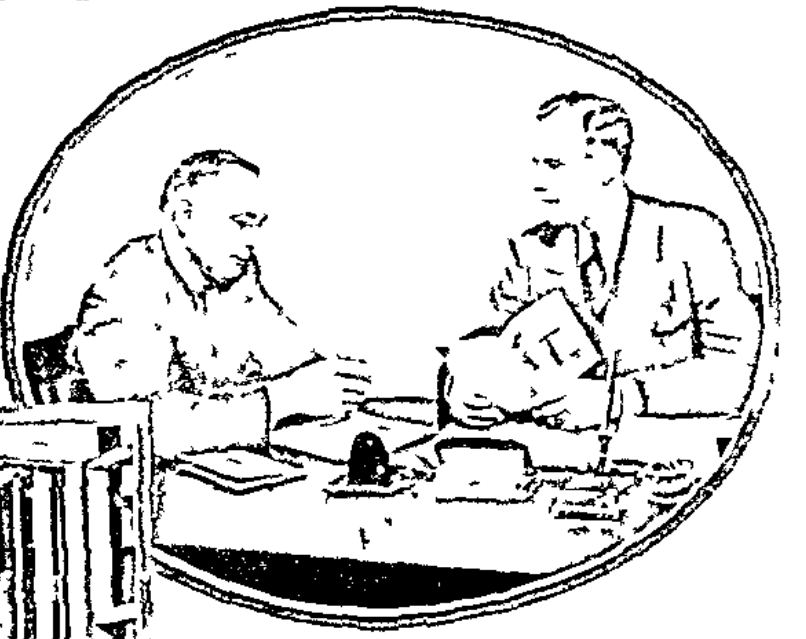
Such experiences carry many of the pupils on to special interests which they are en couraged to develop in junior high and high school In a hundred high schools in and around Los Angeles boys and girls are being guided toward industrial jobs Prac tice accompanies theory and their stud es take on the realism of day by-day work

Educators know that most high school students cannot find jobs immediately on graduation It is to help avoid this loss in manpower that efforts are being made to fit men and women to industrial jobs and in the Frank Wiggins Trade School a free public institution administered by the Los Angeles City Board of Education both youths and adults may prepare in all trades Thousands who started by building planes from blocks become skilled aircraft design ers mechanics and sheet metal workers

All students here work with their hands There are no entrance examinations Ad

TO REAL JOBS

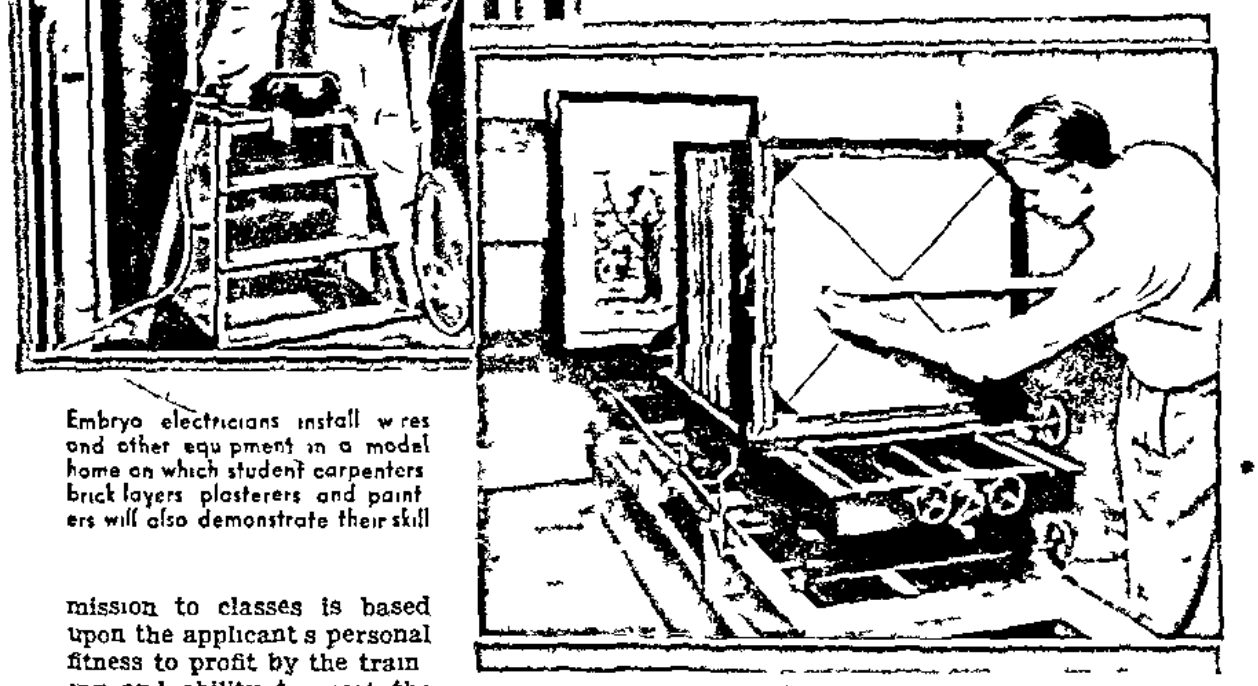
Vocational Training from Kindergarten to High School Fits Students To Follow Careers in Industry



Finding jobs for students a trade school official confers with an expert on building trades labor



Preparing for a career in industrial photography this boy is learning to operate a copying camera



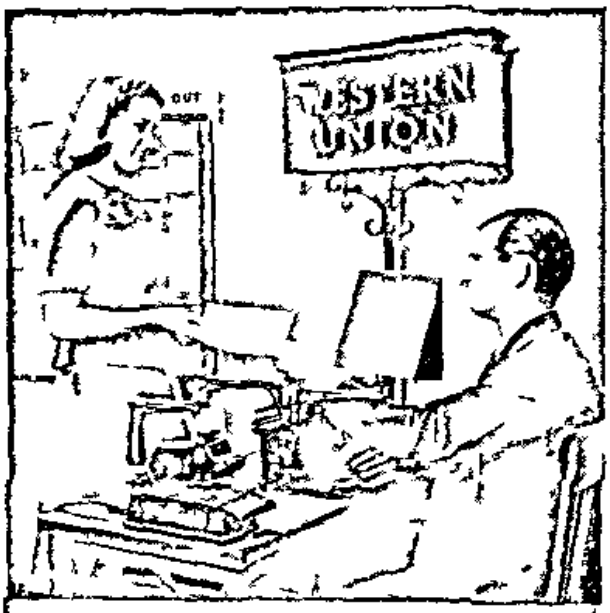
Embryo electricians install wires and other equipment in a model home on which student carpenters brick layers plasterers and painters will also demonstrate their skill

mission to classes is based upon the applicant's personal fitness to profit by the training and ability to meet the trade requirements for employment. Depending upon the demands of the trade for which he proposes to fit *himself*, he may either have finished the eighth grade, or high school. Since the school proposes not only to train for, but also find a job, each student learns a single specialty

There are no terms or semesters Students may enter any time, and leave when they find employment Advisory committees rep-

resenting 201 employment levels meet regularly with the instructors mapping study courses and finding jobs for both boys and girls But the school s influence does not end here Workers already employed flock to the classrooms where they learn new industrial developments in their various fields and perfect themselves in modern working methods

After a student has left school thousands of follow ups trail him for years for trade education of this sort, to be completely successful must make sure that square pegs are fitted into square holes Because of these intensive systems of try outs in the elementary schools and *specialized one job training in the trade* school employers figuratively stand in line waiting to hire trade specialists the minute their instructors pronounce them qualified There s no wait between the Frank Wiggins certificate of eligibility and a job These boys and girls know where they re going

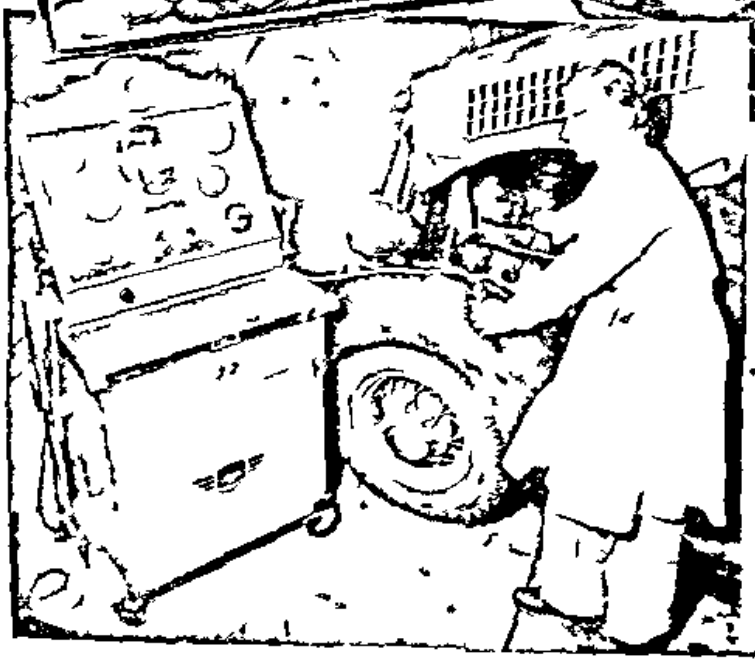


A student learning telegraph office routine Many large industrial concerns lend equipment to the trade school to help supply competent workers



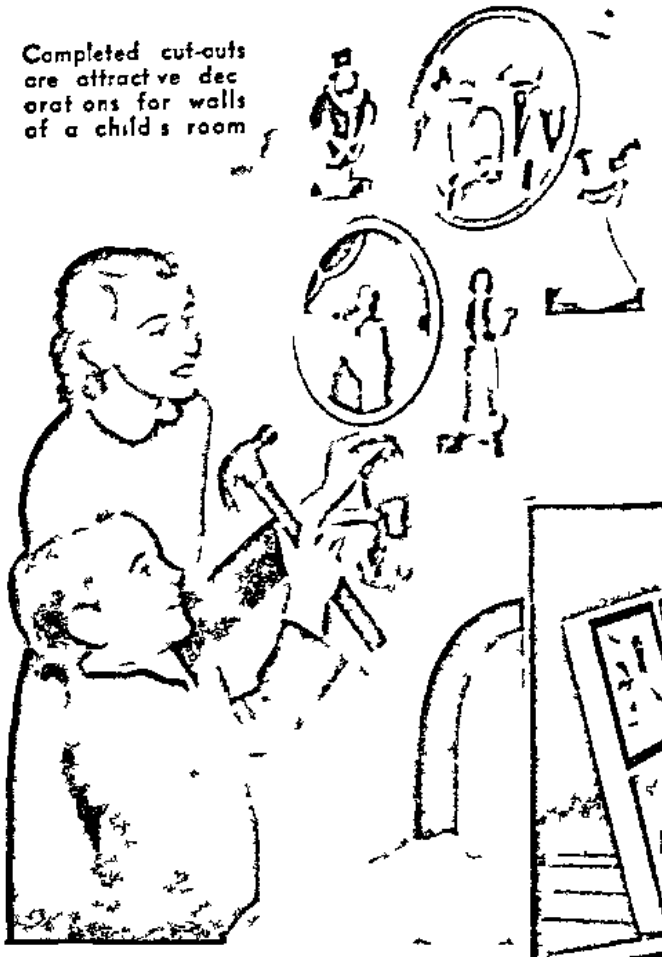


Commercial art is only one of the forty three kinds of work taught to girls This student is sketching a shoe for an advertisement Special aptitudes shown in early studies determine later training



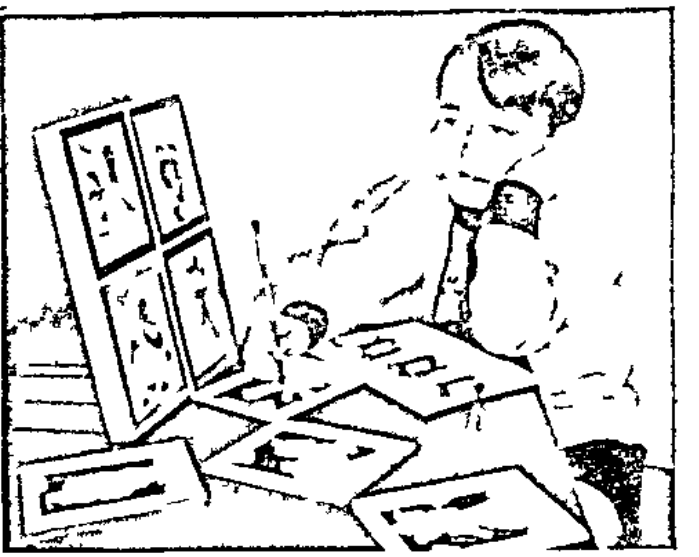
Boys learning to be automobile mechanics must eat their own cooking by keeping their cars in repair At the left one of them is learning how to use a gage testing panel In inset another budding Gus Wilson is putting new finish on a fender

Completed cut-outs are attract ve dec orat ons for walls of a child s room



Cartoon Characters Cut Out of Wood

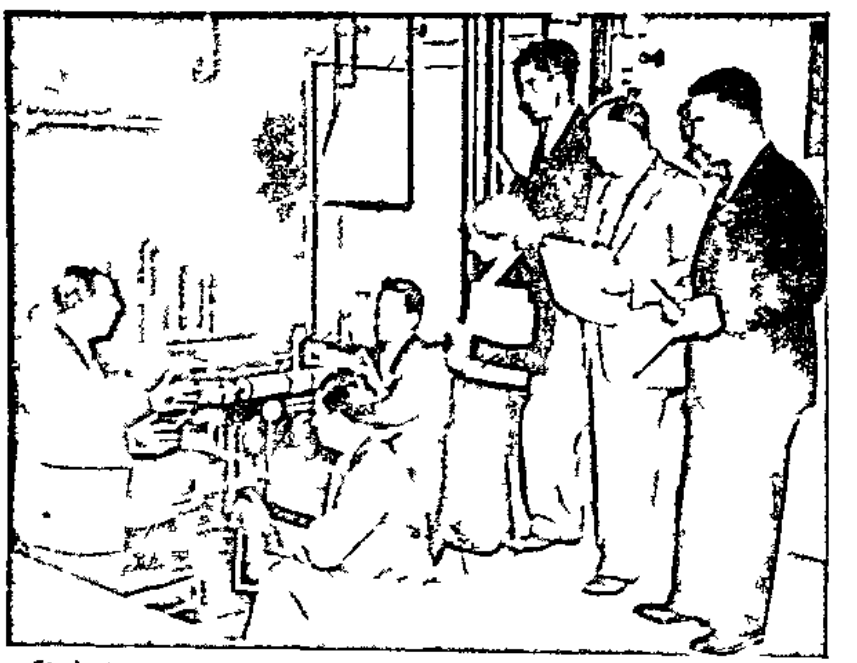
FIGURES of characters seen in moving picture cartoon features are out lined on soft wood boards recently put out in packaged form by a novelty manufacturer as an educational toy intended to amuse and instruct children The outlines make it easy to cut out the figures which may then be painted in appropriate colors and fastened to play room or nursery walls for permanent decorations as pictured in the photograph at the left.



B lly Lee young mov e actor apply ng colors to F gures of an mated cartoon heroes and heroines cut from soft wood

College Course Helps Janitors Brush Up

A COLLEGE course for school janitors is a novel addition to the curric ulum of Teacher s Col lege Columbia University, in New York City Given under the super vision of Dr Henry H Linn once a janitor himself and now super intendent of grounds and buildings at the school the intensive course runs for five days and includes instruction in the best methods of sweeping floors polish ing furniture cleaning woodwork and operat ing coal and oil burning furnaces Round table discussions and stu dent teacher consultations are held.



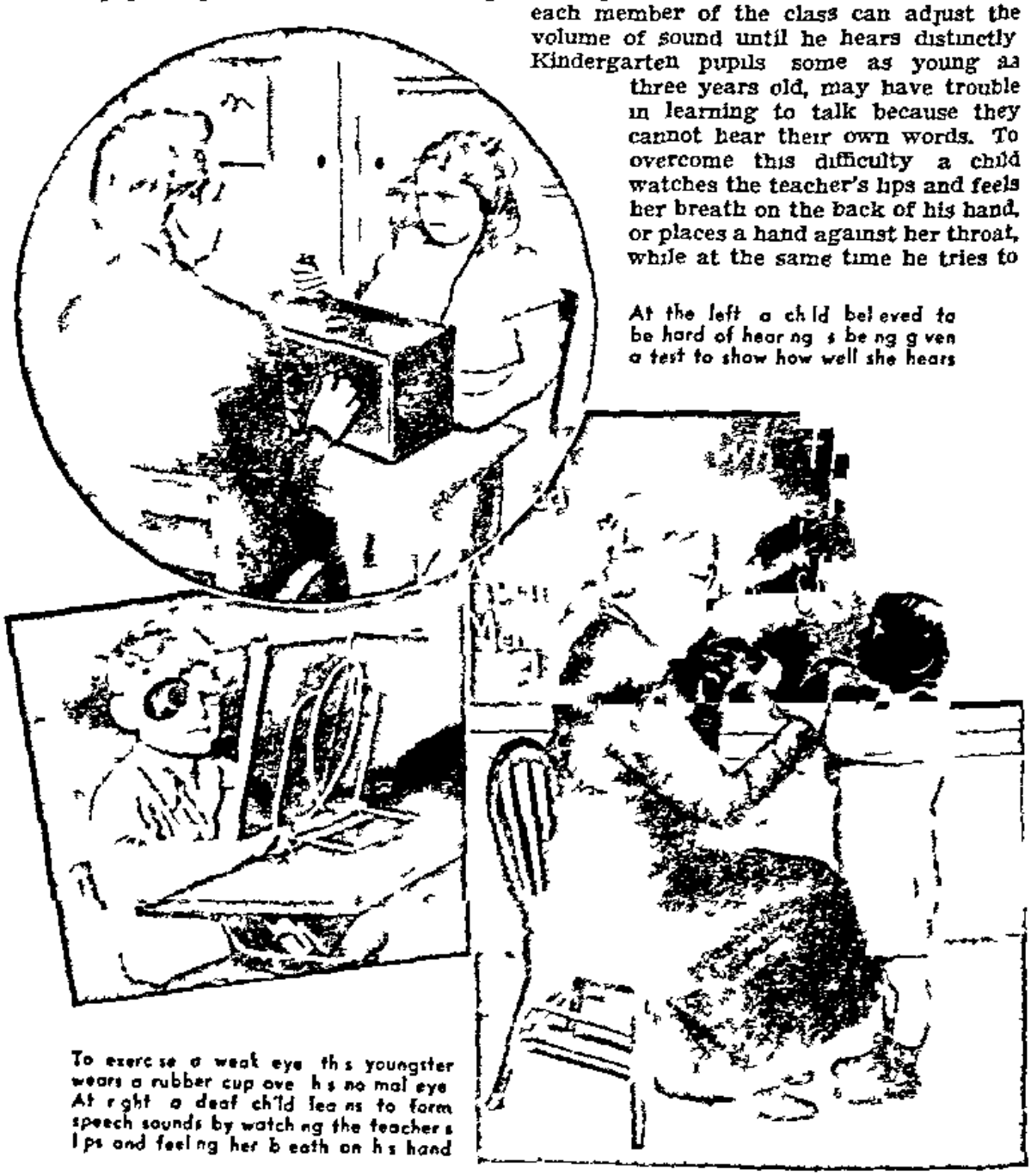
Student jan tors get some pointers on operat ng an o l burner furnace

New Eyes and Ears

SPECIALLY built classrooms novel sound amplifying systems and many other sc entific aids are now making it eas er for school children who are handicapped by defective hearing or im paired vision. Photographs on these pages show how it is done at Long Beach, Calif where education authorities have provided a striking example of the latest techn que

Each pupil suspected of deafness among the 25 000 children in the Long Beach public school system receives a test with an audiometer This instrument, outwardly resembling a radio cabinet with headphones determines how much a child actually hears.

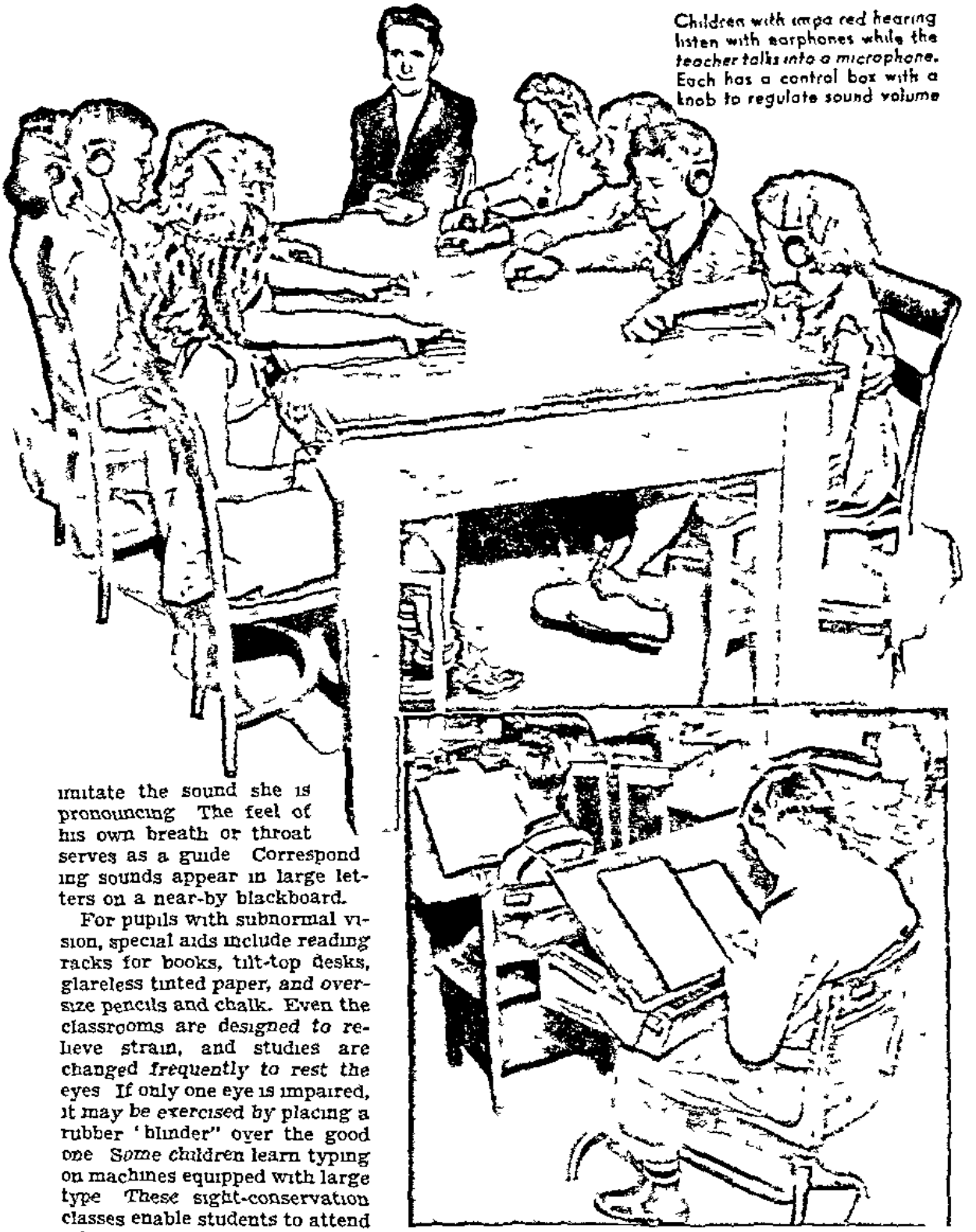
Pupils showing marked impairment of hearing enter a special class whose teacher talks into a microphone connected to an amplifier They listen through earphones By turning a knob on an individual control box, each member of the class can adjust the volume of sound until he hears distinctly Kindergarten pupils some as young as three years old, may have trouble in learning to talk because they cannot hear their own words. To overcome this difficulty a child watches the teacher's lips and feels her breath on the back of his hand, or places a hand against her throat, while at the same time he tries to



At the left a ch ld bel eved to be hard of hear ng s be ng g ven a test to show how well she hears

To exerc se a weak eye th s youngster wears a rubber cup ove h s no mal eye At r ght a deaf ch ld lea ns to form speech sounds by watch ng the teacher s l ps and feel ng her b eath on h s hand

for Students



Children with impaired hearing listen with earphones while the teacher talks into a microphone. Each has a control box with a knob to regulate sound volume

imitate the sound she is pronouncing The feel of his own breath or throat serves as a guide Corresponding sounds appear in large letters on a near-by blackboard.

For pupils with subnormal vision, special aids include reading racks for books, tilt-top desks, glareless tinted paper, and oversize pencils and chalk. Even the classrooms are designed to relieve strain, and studies are changed frequently to rest the eyes If only one eye is impaired, it may be exercised by placing a rubber 'blinder" over the good one Some children learn typing on machines equipped with large type These sight-conservation classes enable students to attend school even when being treated by an eye doctor.

A tilt top desk brings this student s work close to his eyes. Oversize pencils and glareproof tinted paper reduce eye strain

One-Wheel Skate for Rough Ground



ONE WHEELED roller skates provide a novel means of locomotion for a young inventor of Los Angeles Calif The oversize wheels adapt the skates for use in places where there are no sidewalks or paved roads



Coach Uses "Blocking Recorder"

TO AID in training football players a blocking recorder has been devised by a Texas coach Figures on an illuminated panel illustrated above correspond to the eleven men of a team Watching a practice play the coach flashes on a green light for each man who has made a block correctly and a red light for each who has failed By glancing at the recorder members of the team get individual reports on their performance without need of verbal admonition from the coach

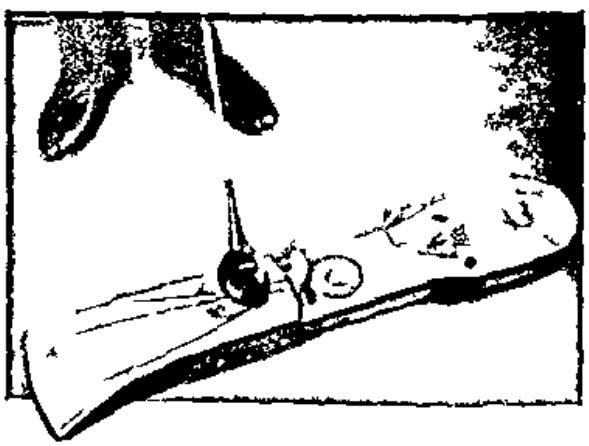
Wire Coils Clean Shotgun Barrel

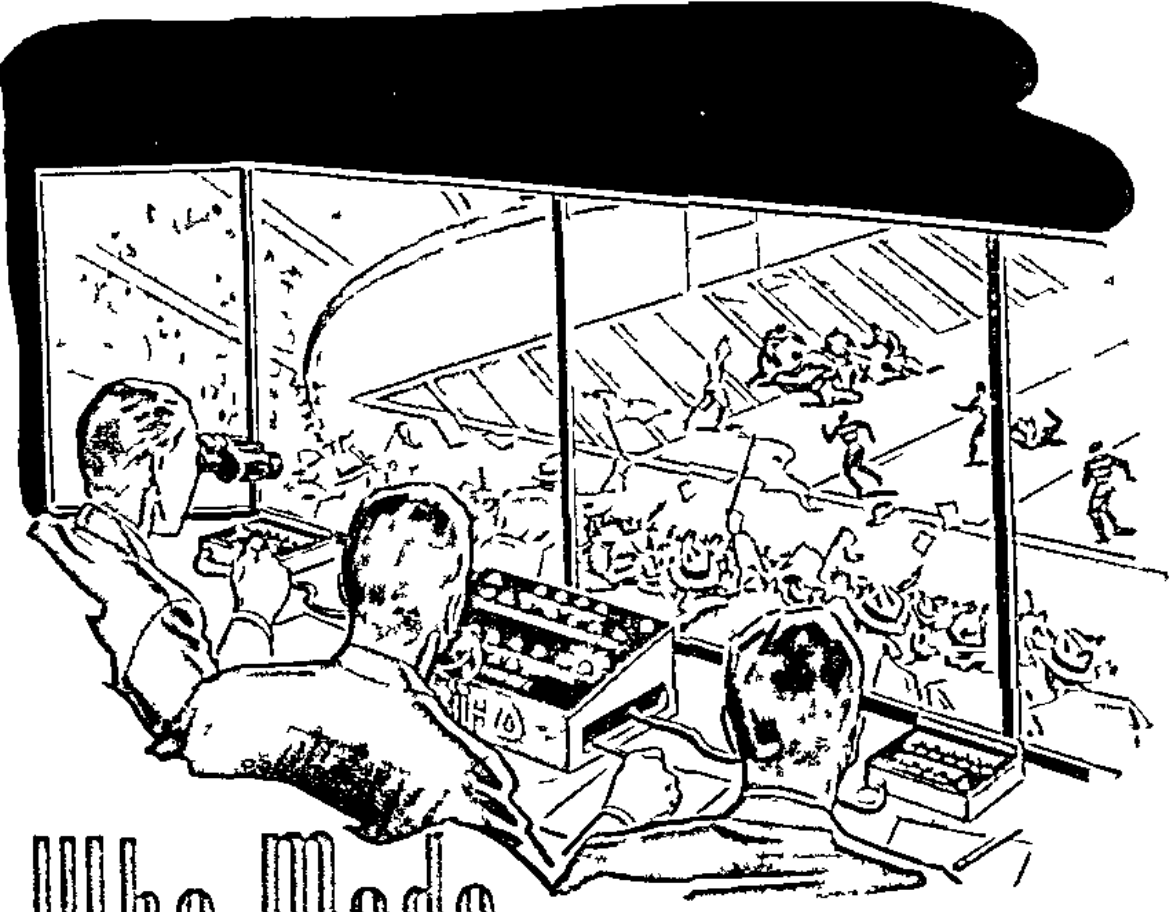


FOR cleaning a shotgun a new tool employs self sharpening coils of bronze wire soft enough not to damage the steel barrel but hard enough to remove lead or rust The device may be fitted to a regular shotgun cleaning rod or pulled through the barrel with a stout cord

Golf-Drive Practice Aid Registers Hook or Slice

A NEW indoor practice aid for golfers not only registers how far a drive would carry but also whether it was sliced or hooked Upon the impact of the club an upright piece of rubber bends to strike a circular disk registering the distance of the drive in yards upon a dial An arrow directly in front of the disk shows the direction the ball would travel and a lever at the side resets the mechanism for another try

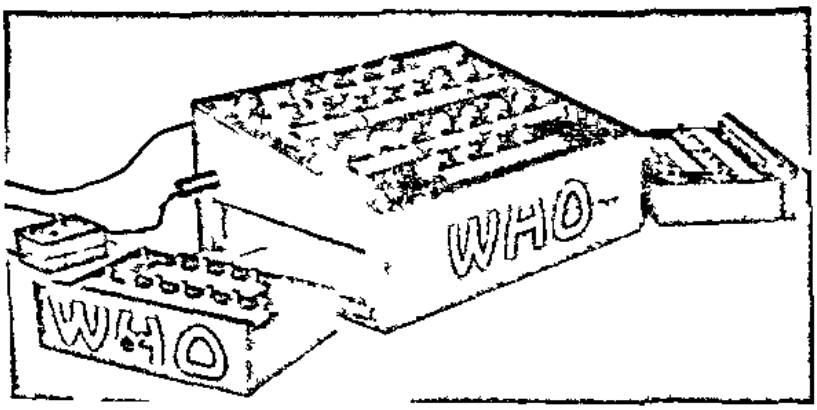




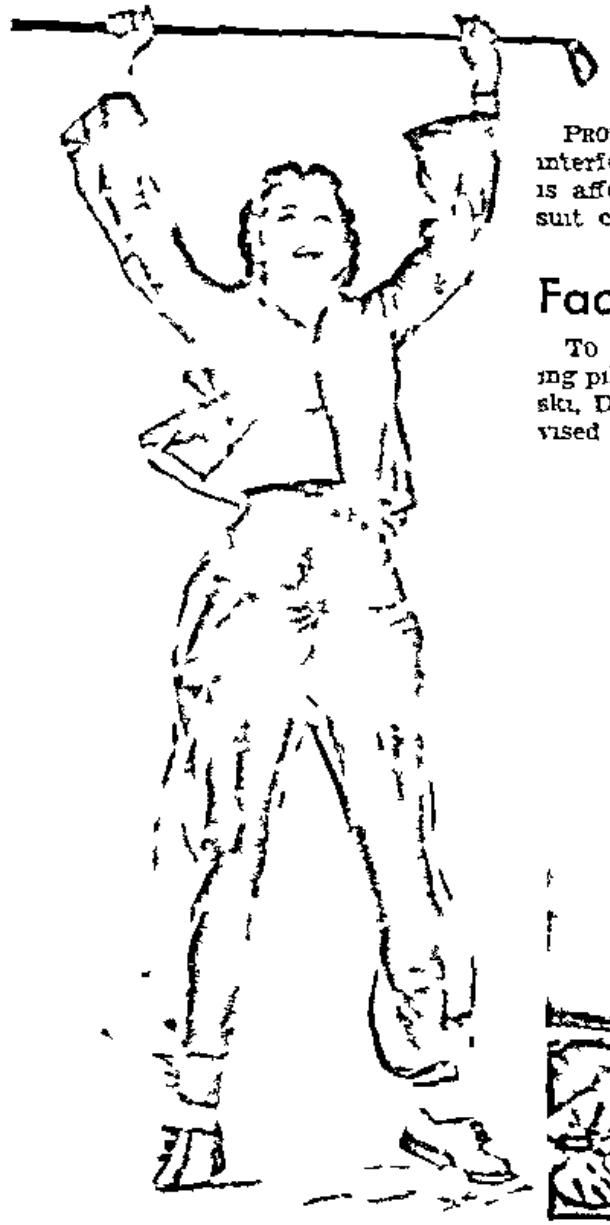
Who Made That Play?

"SPOTTING" DEVICE AIDS FOOTBALL ANNOUNCER

HOW can radio announcers follow the complicated maneuvers of a football game and still identify by name the ball carrier, tackler and other players involved in the action? One answer to the problem worked out by John Beeston research engineer for radio station WHO in Des Moines Iowa is pictured below In front of the announcer is a slant top box equipped with lights representing all the players on the home and visiting teams Wires lead out to smaller control boxes one set in front of an assistant or spotter familiar with the visiting football squad and another in front of a home squad spotter The smaller units contain eleven buttons which actuate lights on the main board As the teams go into action the spotters press buttons below the names of the backs or linemen engaged in the play and lights flash on the main board to convey the information instantly to the announcer If a spotter makes a mistake he presses a twelfth button which flashes a special light to inform the announcer and thus enable him to correct the error as soon as possible



Lights on the larger panel dent fy players as spotters press buttons

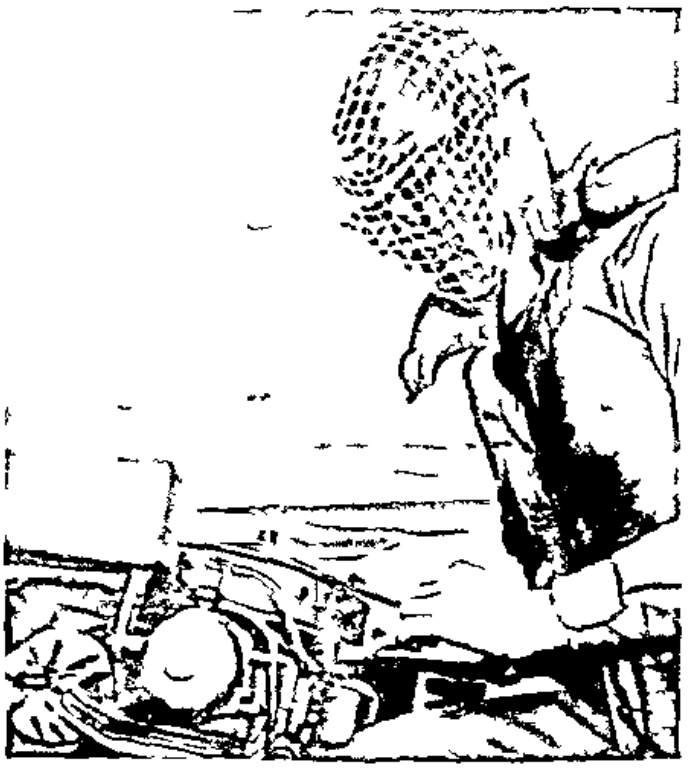


Lightweight, Transparent Rain Suit for Golfers

PROTECTION from rain without noticeable weight or interference with the wearer's freedom of movement, is afforded golfers by a transparent rain suit. The suit consists of a long sleeved jacket and trousers.

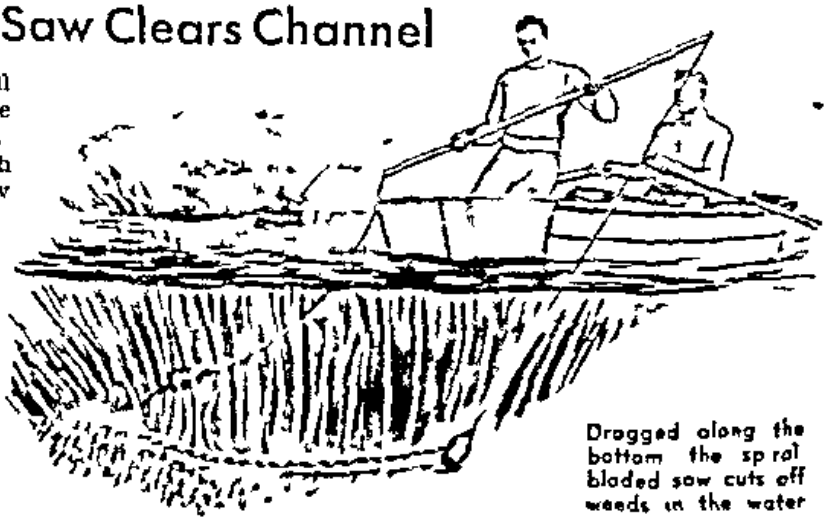
Face Net Protects Boat Racer

TO PROTECT the faces of outboard motor boat racing pilots from possible injuries in spills, Mike Rogowski, Detroit, Mich Outboard Association official, devised the protective cord face net pictured below



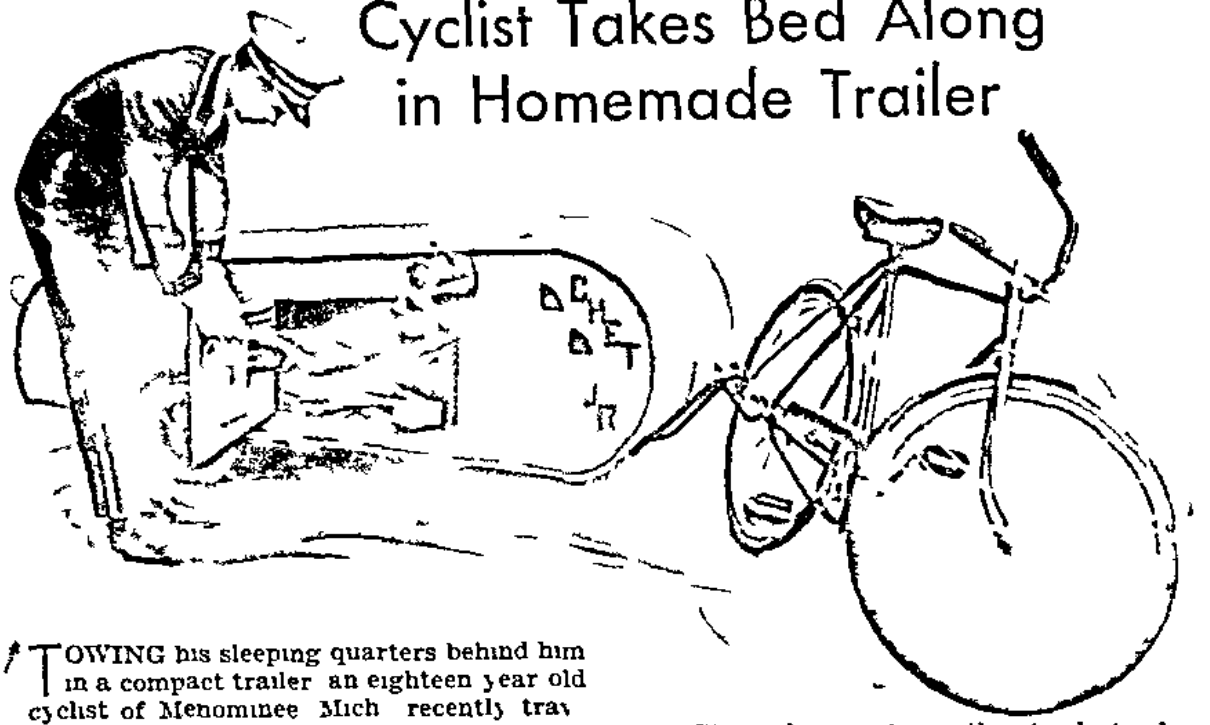
Anglers' Weed Saw Clears Channel

WEEDS that choke small fishing lakes and interfere with the activities of anglers can be eliminated with an ingenious weed saw now available Weighted at the ends the spiral bladed flexible saw is attached by cables to an operating handle and dragged along the lake bottom from a rowboat. The saw is said to work easily at any depth and to clear a ten foot channel.



Dragged along the bottom the spiral bladed saw cuts off weeds in the water

Cyclist Takes Bed Along in Homemade Trailer



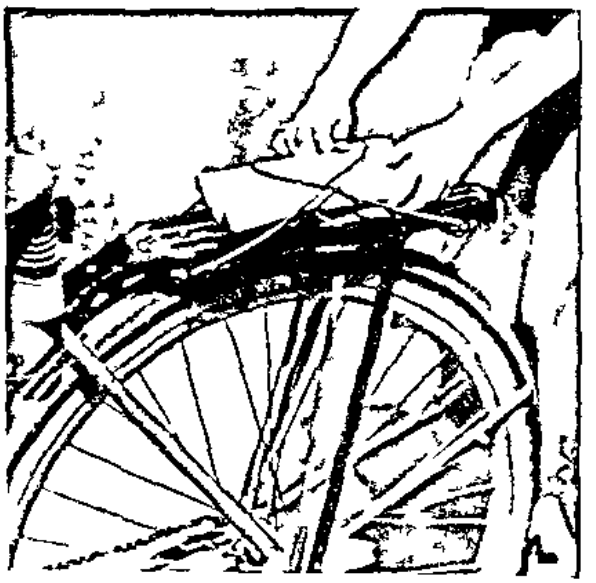
TOWING his sleeping quarters behind him in a compact trailer an eighteen year old cyclist of Menominee Mich recently traveled nearly 1 200 miles to Boston Mass economically and comfortably Post cards that he sold to curious spectators paid for his supplies during the fourteen day journey Streamline in shape the sturdy trailer is a homemade product of his own design He is shown above demonstrating his sleeping quarters to an admiring hotel doorman

Odd Caddie Cart Carries Golf Bag and Clubs

ANY golfer can easily be his own caddie with the introduction of a rolling carrier for a bag of clubs Towed by a handle as shown below the cart travels on rubber tired wheels that will not mar the greens



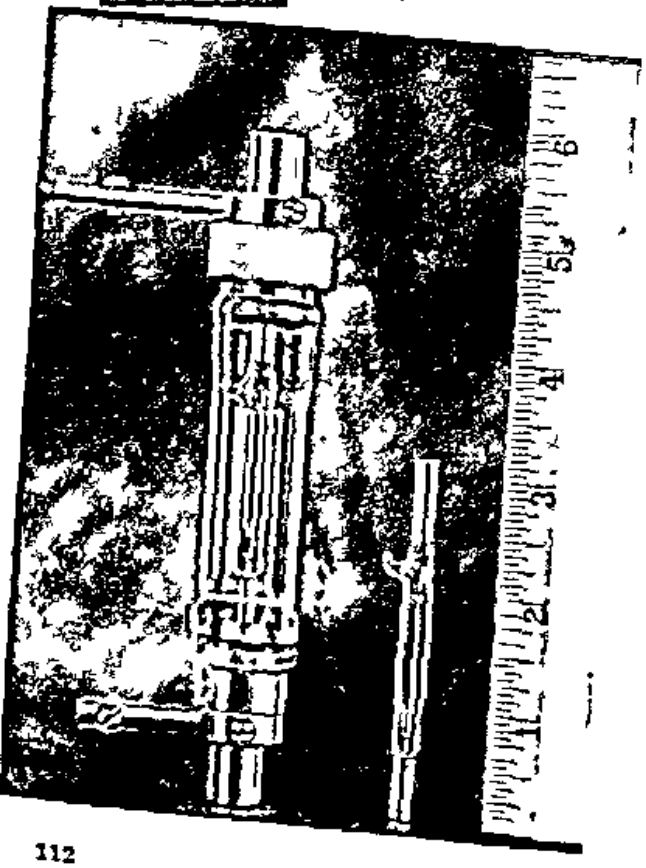
Here is a caddie that won't make wisecracks



Spring Loops Hold Load on Bike Luggage Rack

A HANDY new luggage carrier for bicycles makes it unnecessary to tie or strap the load in place Twin loops of spring metal automatically adjust themselves to hold securely a parcel of any ordinary shape or size as illustrated in the photograph above A built in red reflector button at the back for safety in night riding adds to the utility of the attachment.

Powerful New Lamp Lights the Invisible

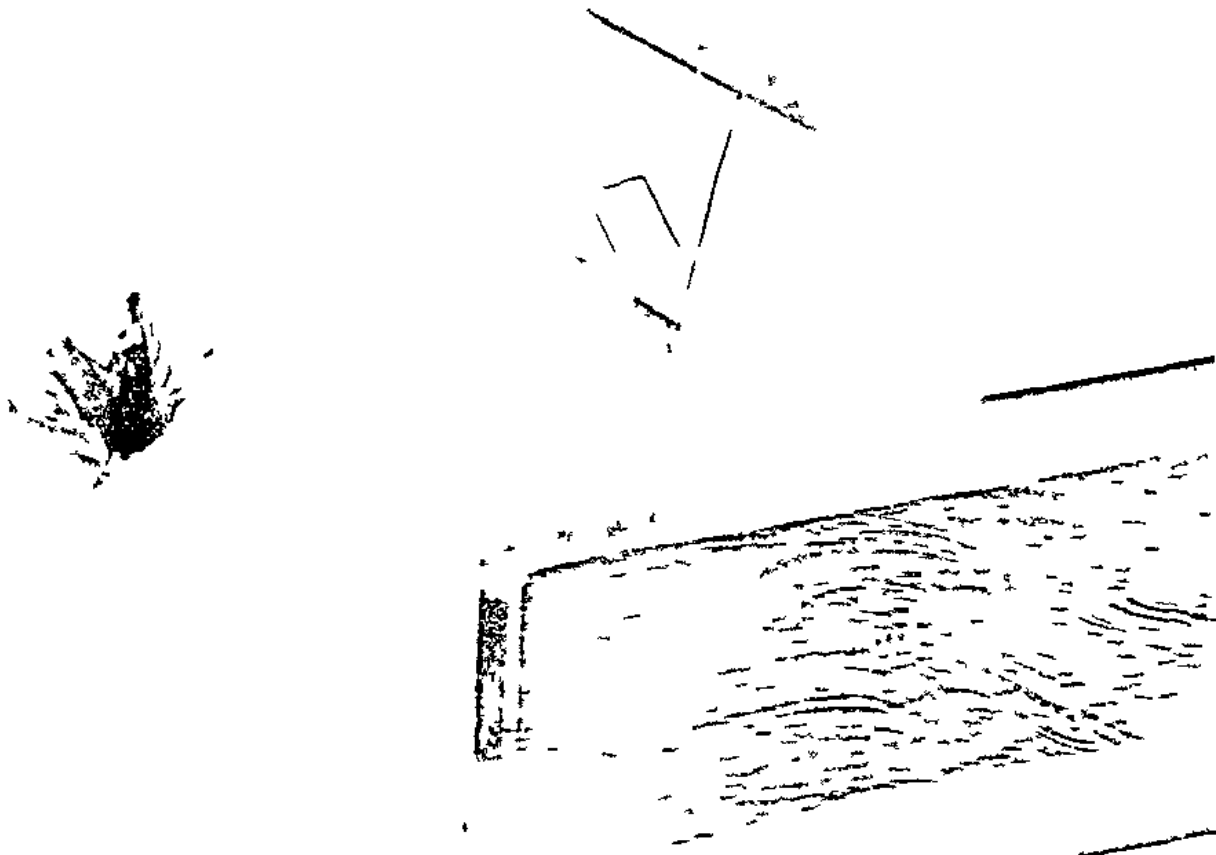


By JOHN E. LODGE

SMELLS become visible, transparent gases take shape, heat and cold can be seen with the naked eye in an amazing scientific shadow show being staged at the General Electric laboratory in Schenectady N Y as a by product of recent research with the world s most powerful electric light—a tiny, dazzling, midget sun

An accidental discovery, a few months ago, revealed what the little lamp would do A quarter of a mile from the laboratory in which Dr N T Gordon and his assistant, Dr. R P Johnson had made the final experiments with the lamp searchlight experts were trying out one of the midget suns in a new type reflector Happening to glance up when the searchlight was concentrating its glare in the direction of his laboratory,

The midget arc lamp and its cooling water jacket It is said to give out a light equal to a fifth of the sun s surface brightness



Dr N T Gordon holds a piece of plate glass in the beam of light Its shadow seen at the right shows circular pol ishing marks and other characteristics

Dr Gordon was surprised to see curious lines of light running through the glass of his windowpane The rays, coming from a source almost as small as a pinpoint, were revealing unseen variations in the texture of the glass

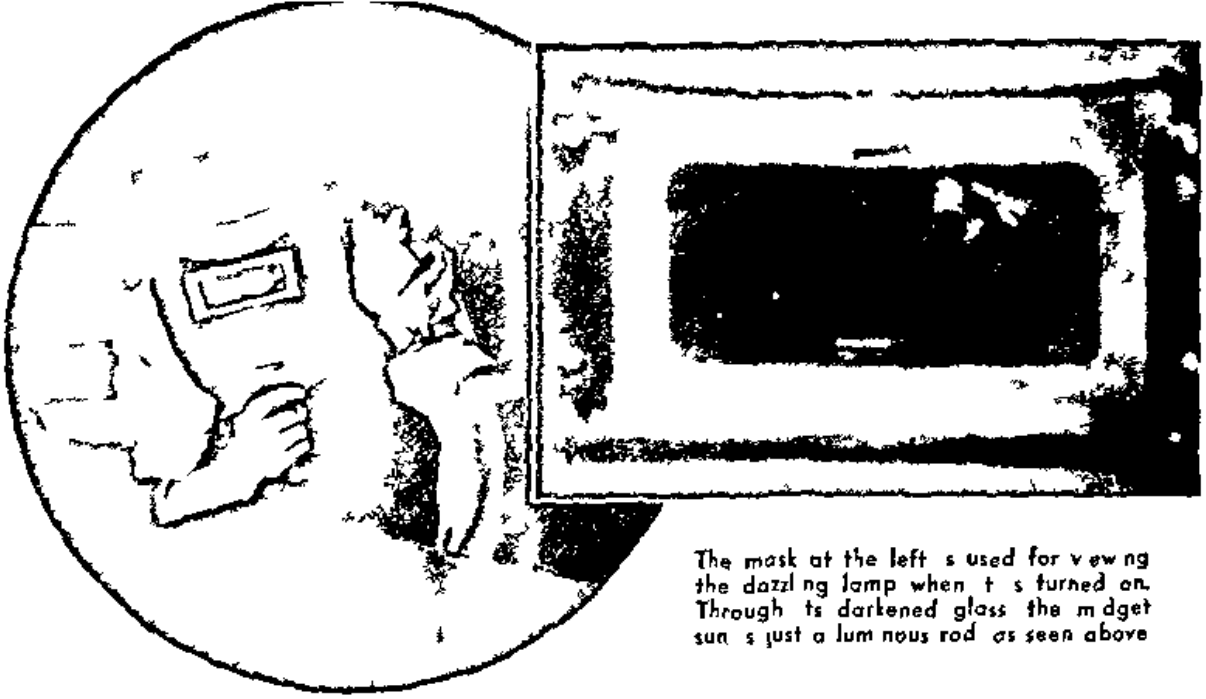
That observation started Dr Gordon exploring the invisible by a new path He installed one of the little lamps in his laboratory and projected the light across the room onto a white screen When the powerful rays of the tiny lamp pass through various liquids, gases and transparent solids, they are refracted, or bent, just enough to throw a shadow on the white screen

Such shadows, looking a great deal like X-ray pictures reveal the invisible in a wide variety of forms During a recent visit to Dr Gordon s laboratory I watched him rub his hands together and then hold them in the path of the light. On the screen appeared the shadow of invisible heated vapor rising from his fingers He uncorked a bottle of perfume and I could see rising above it, a faint cloudlike image the shadow of a smell From a pitcher Dr Gordon poured heavier-than air carbon dioxide gas and on the screen I saw it billow downward to envelop and extinguish a candle flame

When a glass jar of water was placed in the path of the light, I was able to watch chemical reactions and the mixing of colorless fluids Hydrochloric acid, poured



How alcohol mixes with water as revealed by the magic shadows Unlike hydrochloric acid which plunges to the bottom of a glass, alcohol remains near the surface

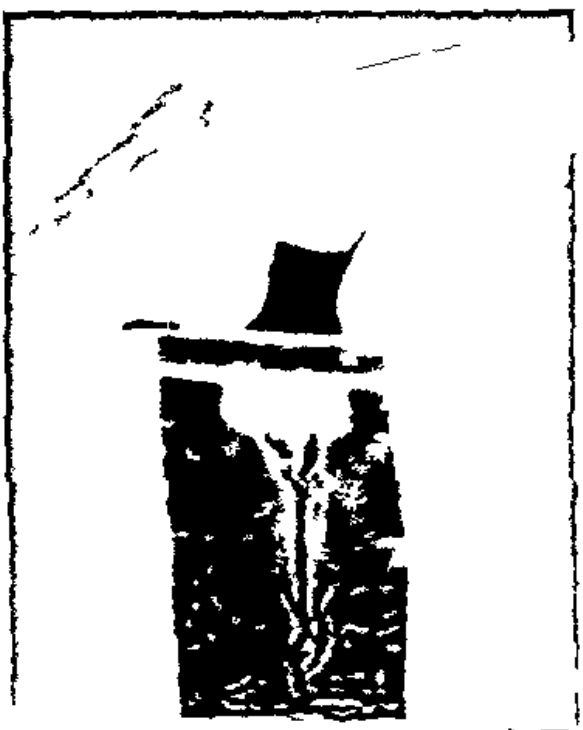


The mask at the left is used for viewing the dazzling lamp when it is turned on. Through its darkened glass the midget sun is just a luminous rod as seen above

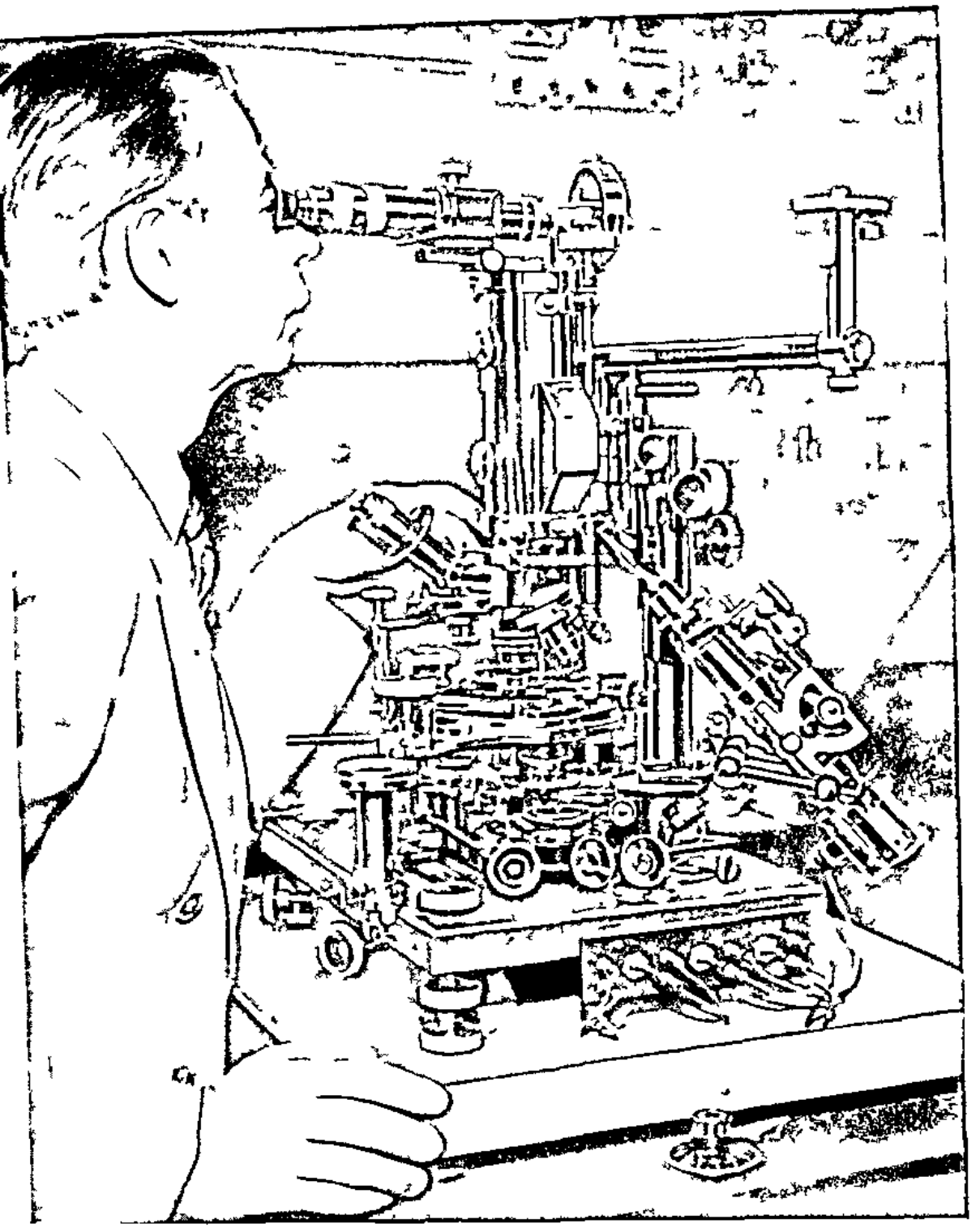
into the water plunged to the bottom and then mushroomed out to either side Alcohol on the other hand swirled about near the surface without descending When a piece of ice was placed in the jar a funnel of cooled descending water penetrated to the bottom Glass tubes rotated in the path of the light produced patterns—some plaid others formed of a series of parallel lines The former had been twisted during manufacture the latter had been rolled Other tests revealed other secrets of glass

Dr Gordon sees a practical application for the technique he has developed in the testing and study of glassware at factories Another field where it may find widespread use is in teaching Through such scientific shadow shows students will be able to see with their own eyes chemical reactions and other scientific occurrences which hitherto have been invisible





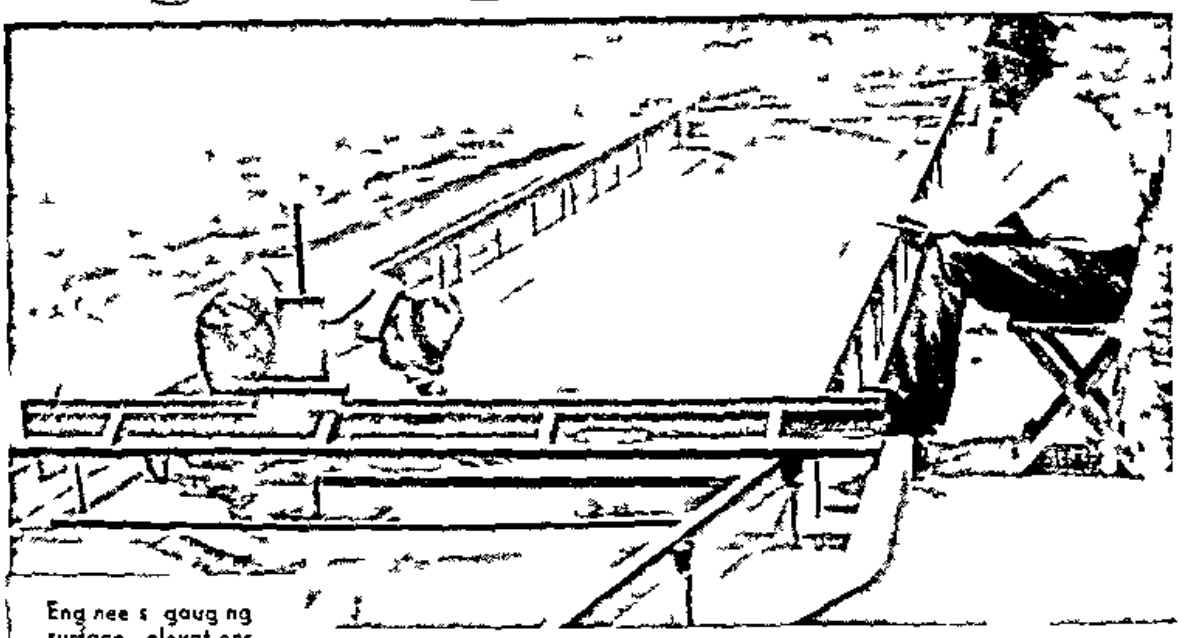
Shadows paint a picture of invisible carbon dioxide gas pouring from a pitcher to put out a candle flame At the right a cold stream flows down from a lump of ice in a jar of water



Giant Microscope Explores New Worlds

REPORTED to be so powerful that it reveals disease organisms never seen before the giant microscope pictured above has just been completed by Royal R Rife of San Diego Calif whose home built instruments have long been ranked among the finest in the world To eliminate distortion the image produced by the new two foot tall apparatus does not pass through the usual air filled tube but along an optical path of quartz blocks and prisms Weighing 200 pounds the microscope has 5 682 parts

Fighting Floods on

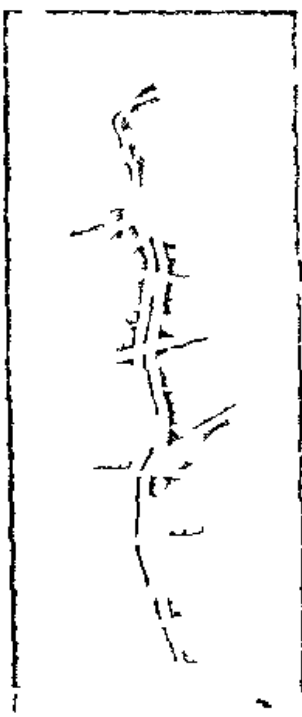


Eng nee s gaug ng surface elevat ons on the scale model of the Los Ange es R ve n a c ty pa k

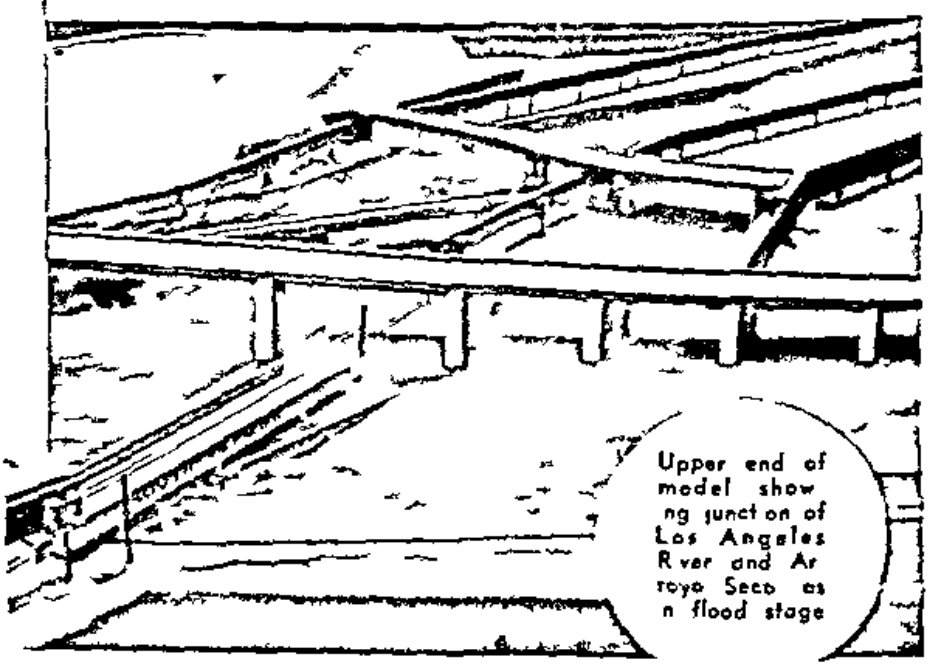
By C. W. WATERMAN

BRIDGE PIERS of novel streaml ne design will let river floods rush smoothly past averting dangerous and costly washouts How to shape them has been learned by U S Army engineers during a year of experiments with a 385 foot model of the Los Angeles R ver in California

Accurately constructed to scale in one of the city s parks the model represents a four m le section of the river passing through metropolitan Los Angeles Along this stretch th rteen br dges and trestles span the stream which is bordered by ra l

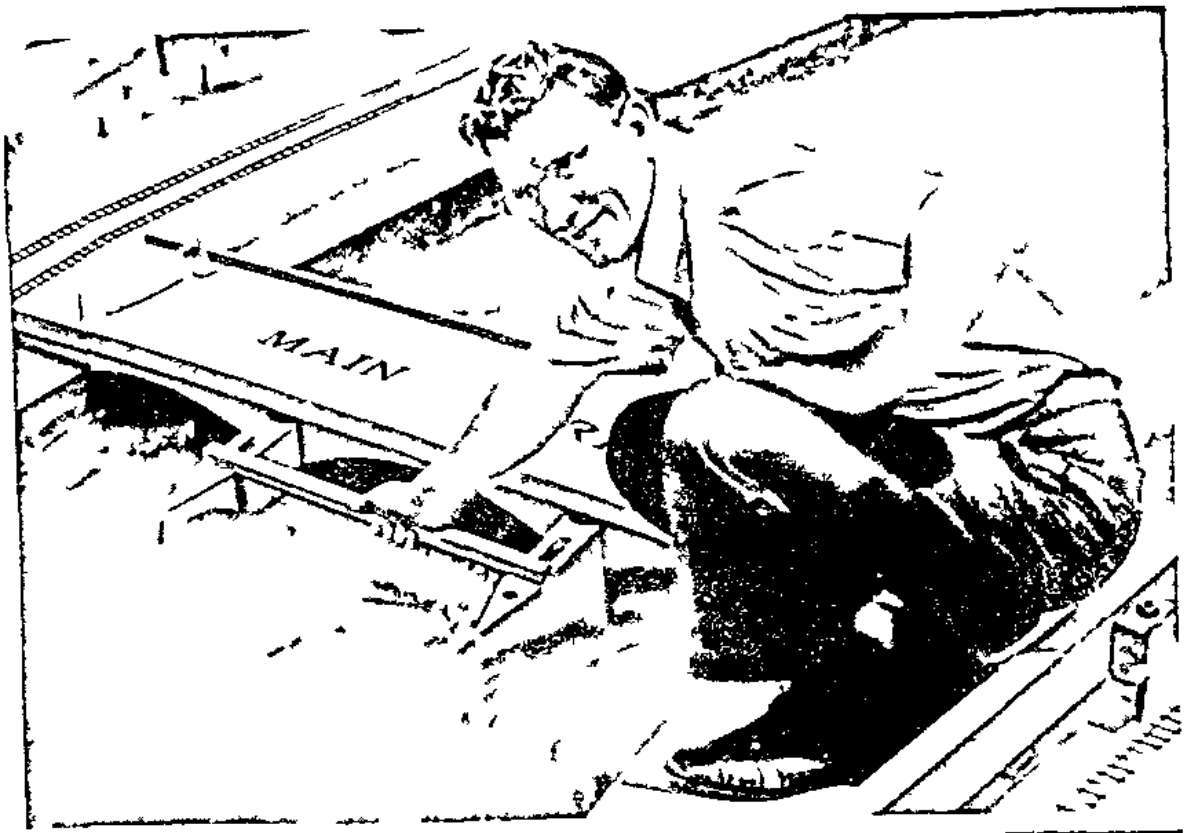


A map of the sect on of the r ver be ng stud ed Note many br dges



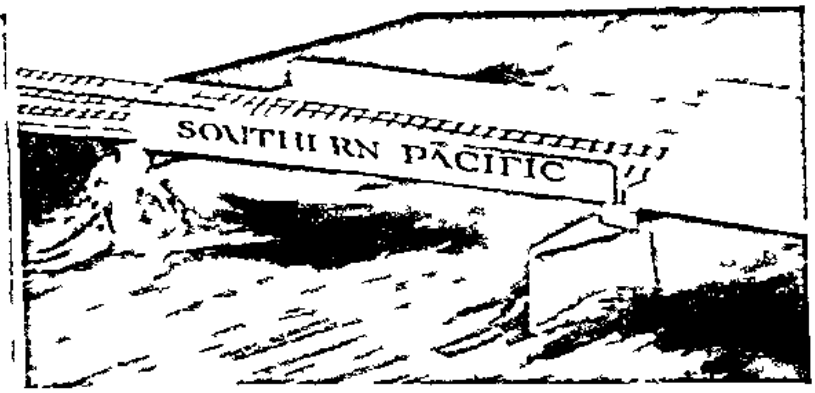
Upper end of model show ng junct on of Los Angeles R ver and Ar royo Seco as n flood stage

a Miniature River



Wedge shaped p er ex tens ons rep esented by the portable model seen above were found to reduce flood level

Water p les up aga nst a common rounded p er wh le sl d ng qu etly past a st eaml ne one



road tracks on both sides A tributary the Arroyo Seco adds to the flood problem Both channels bone dry beds of sand for a part of the year seasonally carry vicious torrents from near by mountains to the sea In the model artificial streams faithfully repro duce the seething currents in miniature

Because obstructions in the stream de termine the height for protective channel walls the engineers have concentrated their attention upon the forest of bridge piers in the d strict. On the upstream side of a span the trouble is backwater —flood water that piles up first against the semicircular faces of the piers and then against the bridge itself often washing over it. This requires high channel walls to prevent over flow At the downstream side of a bridge similar pier faces set up large waves top ping a bank that otherwise would be high enough

Simply by adding wedge shaped exten sions to streamline both faces of a pier all three difficulties are eliminated the engi neers have found When a portable model of the novel fairing is held against a miniature bridge churning waters are magically quieted With a wealth of such new data the engineers are developing a complete flood control plan for the vicinity

Perfumes Help Pay Chemistry Fan's College Expenses

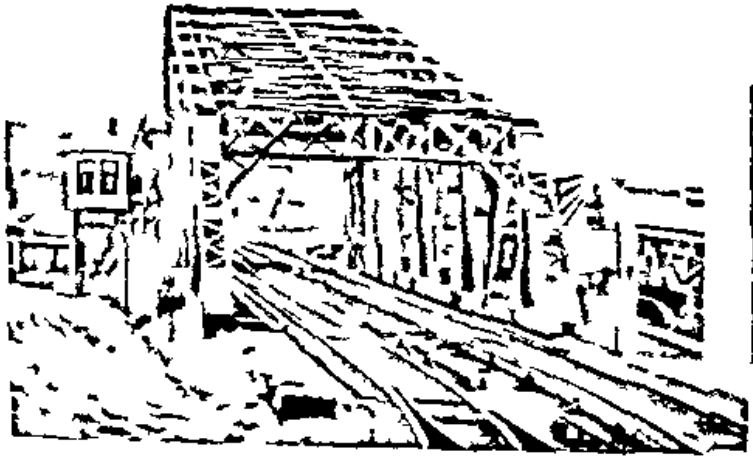


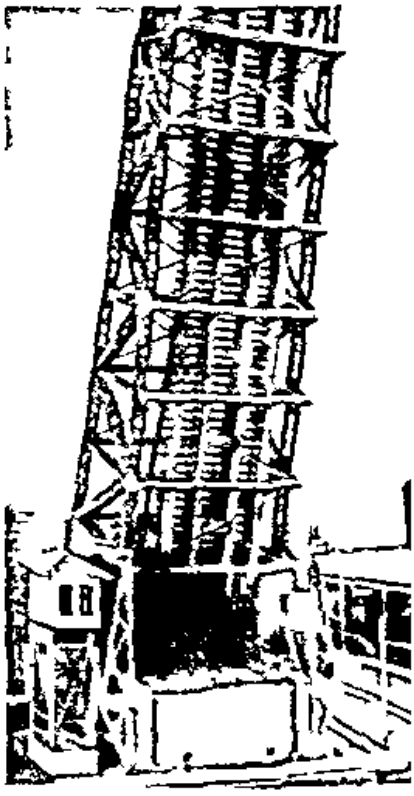
Robert Ma den m x ng chem cals to produce perfumes for sale

GETTING a college education is a matter of scents as well as of dollars and cents to Robert Maid en of Palo Alto Calif When he was casting about for a way to defray part of the cost of a bus ness course at Stanford Univer s ty Maiden now a sophomore decided to make capital of his hobby of chemistry He therefore worked out a selection of chemically produced perfumes which he now concocts himself for sale to campus co eds and to local shops. So successful has the venture become that Maiden may have hit on a full t me money making career which will be in a thriving state by the time he puts his books aside at the end of his college course and starts in to earn a living

Model Railway Gets Rolling Lift Bridge

MORE than 3? 000 rivets were employed in the con struction of the remarkable model railroad br dge pic tured below and at the right. Modeled after the Scherzer rolling l ft bridge that carries trains of the New York New Ha en and Hartford Ra lroad across the Housa tonic River at Devon Conn the scale bridge represents three years of spare time work on the part of Alfred Schellbach of New Haven Conn Tipping the scales at fifty eight pounds the span is thirty seven and a half nches long the scale equ valent of 150 feet. The bridge has been put into service in the miniature railway sys tem of the New Haven Society of Model Engineers.

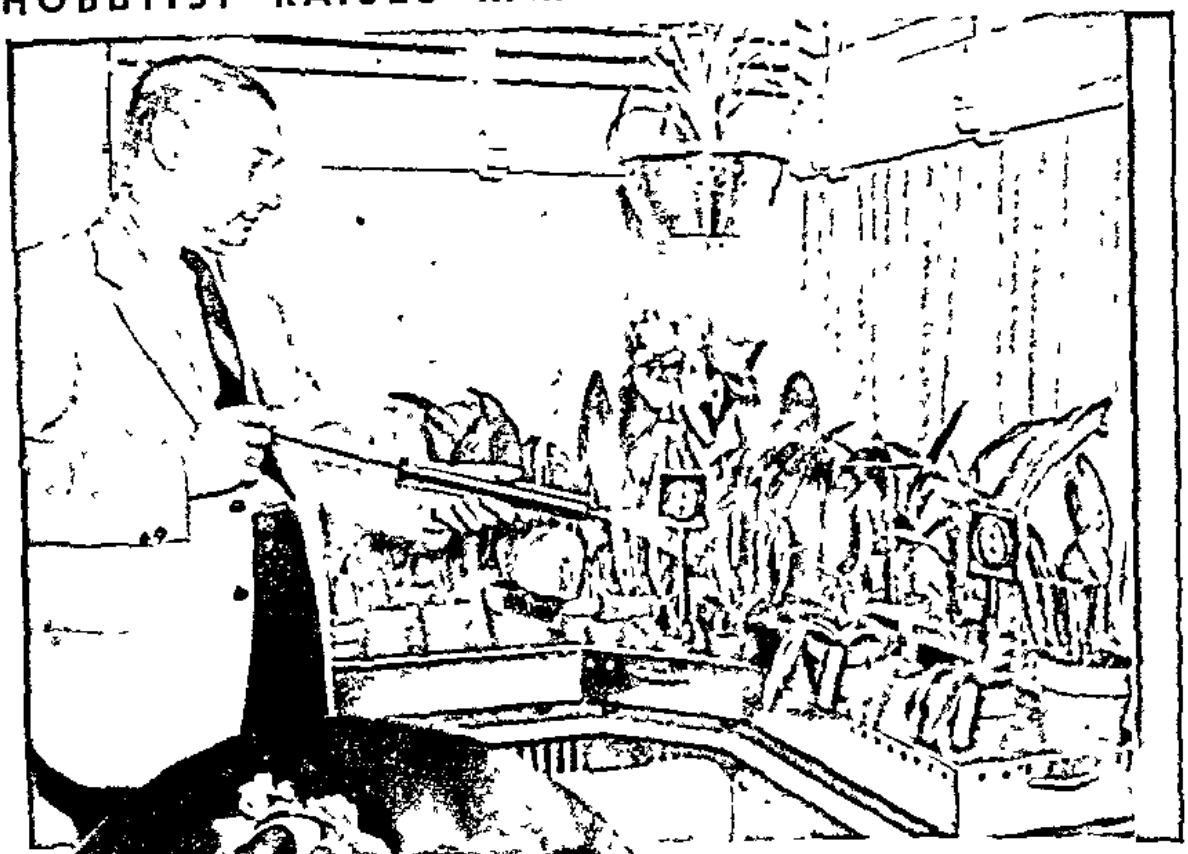




Two v ews of the model roll ng l f br dge Counterwe ghts ra se t fc open the span as llust ated abov

Orchids on a Window Sill

HOBBYIST RAISES RARE TROPICAL FLOWERS



Peter Rolph spraying water onto the orchid plants in his window-sill garden to maintain the proper humidity. At left, one of the exquisite blooms

AN ORIGINAL investment of five dollars, months of painstaking care, and a generous sprinkling of real ingenuity have made a success of Peter Rolph's hobby of raising costly and delicate orchids on a window sill of his New York City apartment. Although professional growers advised against the project, Rolph, a restaurant manager, bought a single five-dollar plant as a starter less than two years ago. Now he has thirty-five healthy orchid plants that insure, among them, at least one exquisite bloom at all times. So far, he has lost only a single plant.

Rolph knew that orchids in their native tropical habitat thrive on an atmosphere high in moisture content. To assure the plants of sufficient humidity, he placed them in special pans of nonrusting metal and set them on top of a corner radiator grill. Sheets of asbestos in the pans soak up and maintain the required moisture, while thermometers and humidity gauges in each pan help Rolph keep an accurate check on atmospheric conditions. A special oil-silk curtain masks the windows adjacent to the orchids to shield them from

the direct rays of the sun while still affording them the abundance of light they require

Containers used for the plants are ordinary flower pots In the bottom of each are placed some pieces of broken pottery covered with a layer of sphagnum moss The loose pieces prevent the moss from packing down too tightly and also assure a free circulation of air around the plant roots

Humidity is maintained between forty and sixty percent and the temperature between seventy and eighty degrees F When ever humidity shows signs of falling below the danger point the hobbyist goes to work with a spray gun full of water One of the secrets of his success Rolph believes is the fact that he gives constant and unfailing attention to each plant. Once a week he examines every plant leaf for signs of insect pests or blights of one kind or another Each leaf is swabbed clean with a silk sponge and then the entire plant is washed under a fine spray

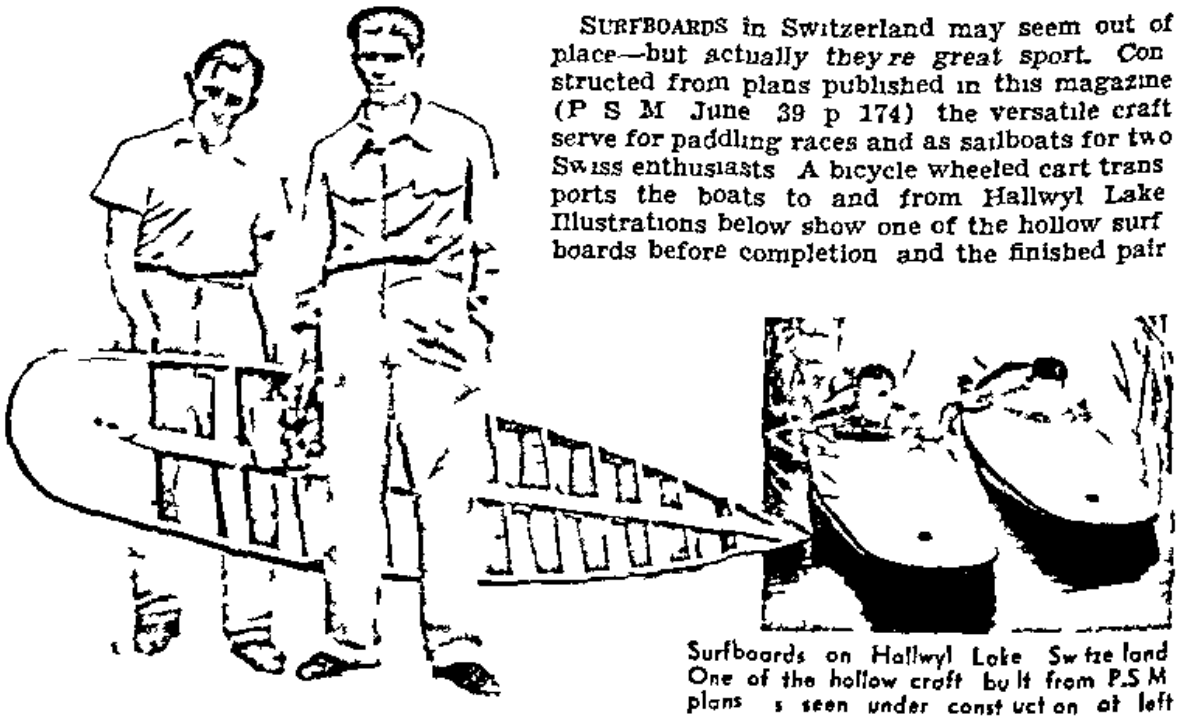
Probing the plant roots and at right brushing off insect pests



Orchids get a weekly bath in the kitchen sink with a sponge of silk as at the right

In a number of the species that he grows the orchids may be propagated by subdividing By removing the separate root growths and placing them in individual pots new plants are started as desired.

Surfboards from P.S.M. Sail Swiss Lake

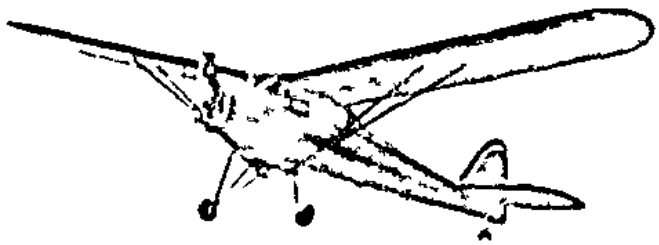


SURFBOARDS in Switzerland may seem out of place—but actually *they're great sport.* Constructed from plans published in this magazine (P S M June 39 p 174) the versatile craft serve for paddling races and as sailboats for two Swiss enthusiasts A bicycle wheeled cart transports the boats to and from Hallwyl Lake Illustrations below show one of the hollow surfboards before completion and the finished pair

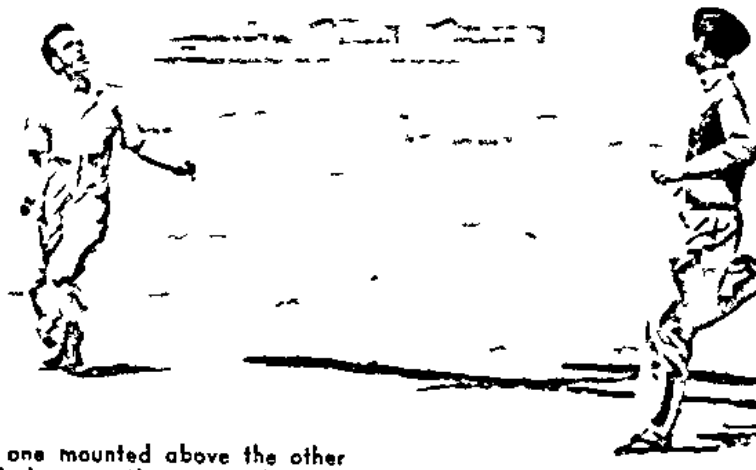
Surfboards on Hallwyl Lake Switzerland One of the hollow craft built from P.S.M. plans is seen under construction at left

Twin Motors Run Giant Model Airplane

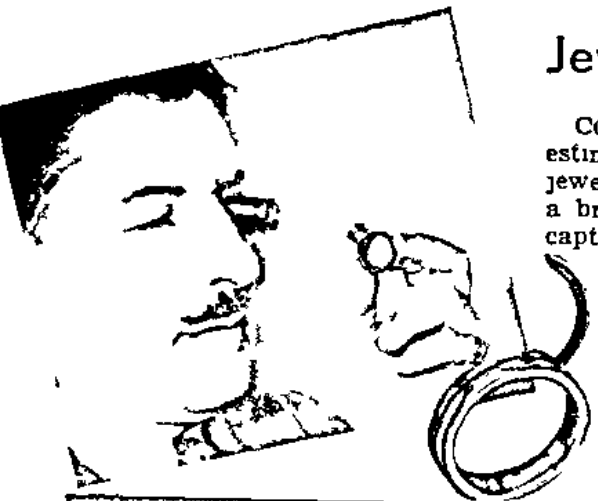
A GIANT in its class, a model airplane owned by Orin Anderson, of San Antonio, Tex., is propelled by twin motors placed one above the other Originally constructed by an airplane mechanic at the U S Army Air Corps training center at Kelly Field, Tex., the monoplane was designed to be controlled in the air by radio When that idea was abandoned Anderson acquired the ship in trade for model parts and now flies it as an ordinary model airplane with the controls fixed in one position







It takes two tiny gasoline engines one mounted above the other to propel the oversize plane model shown in the air at the right



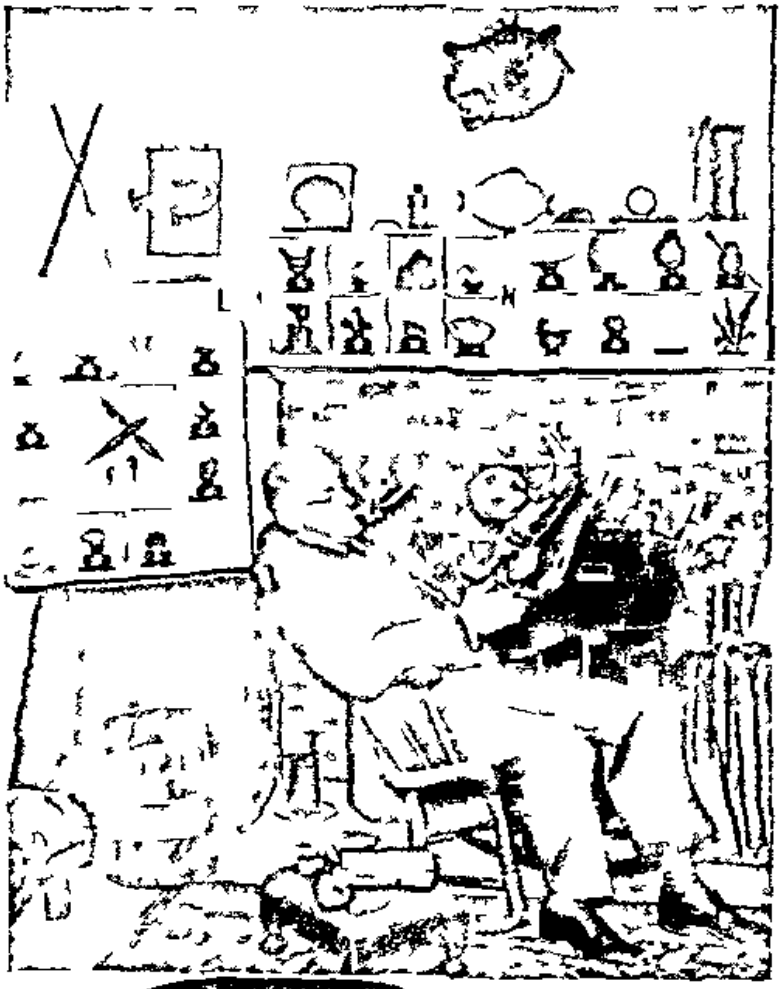
Jeweler Collects Finger Rings

COLLECTING old and rare finger rings is the interesting hobby of Charles Harris, a New York City jeweler Among the many items in the collection are a bronze ring made for Napoleon Bonaparte from captured Russian cannon, a gold ring containing a sharp steel knife blade that springs out at the touch of a button, and an ancient poison ring set with an emerald and two rubies The latter ring has a hollow band designed to contain a liquid poison Pushing one of the gems causes a poison-coated pin to jut out from the ring band Harris s father started the collection fifty years ago

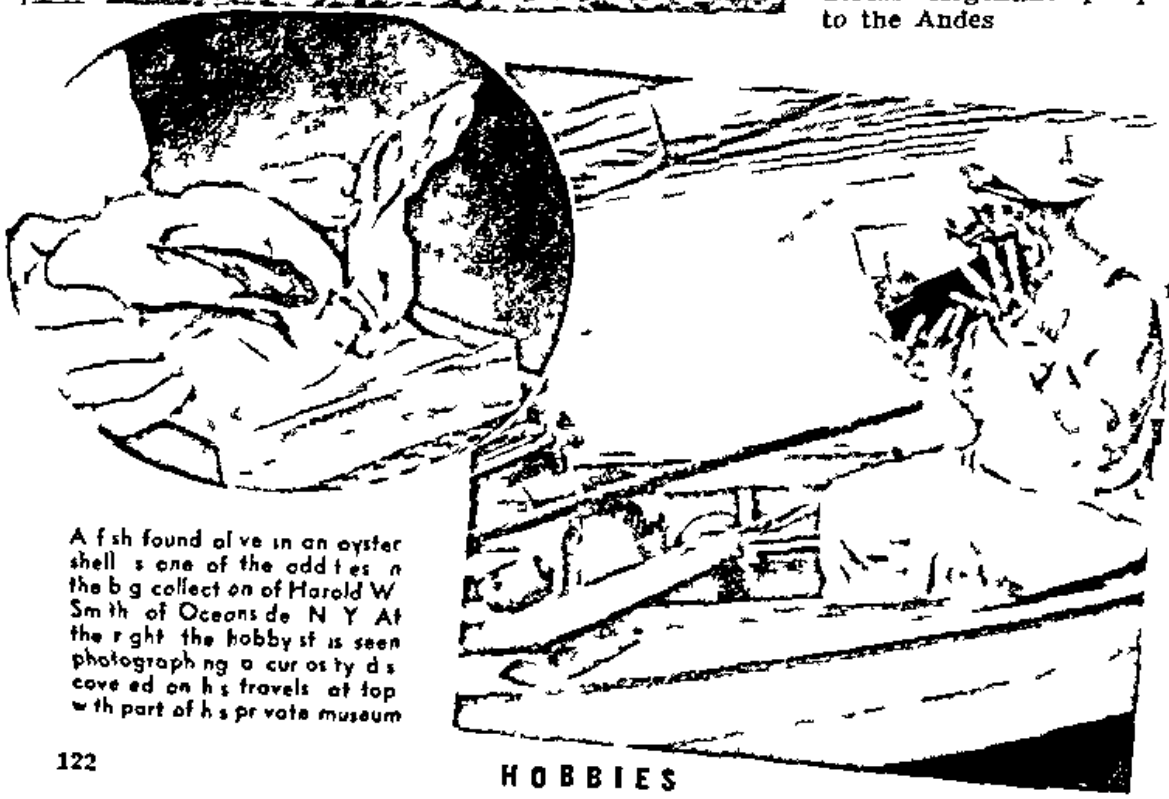


Rare old finger rings in the collection of Charles Harris, of New York City seen above examining a ring made for Napoleon Bonaparte from captured cannon The ring in inset conceals a sharp steel blade

Globe-Trotter Collects Curios

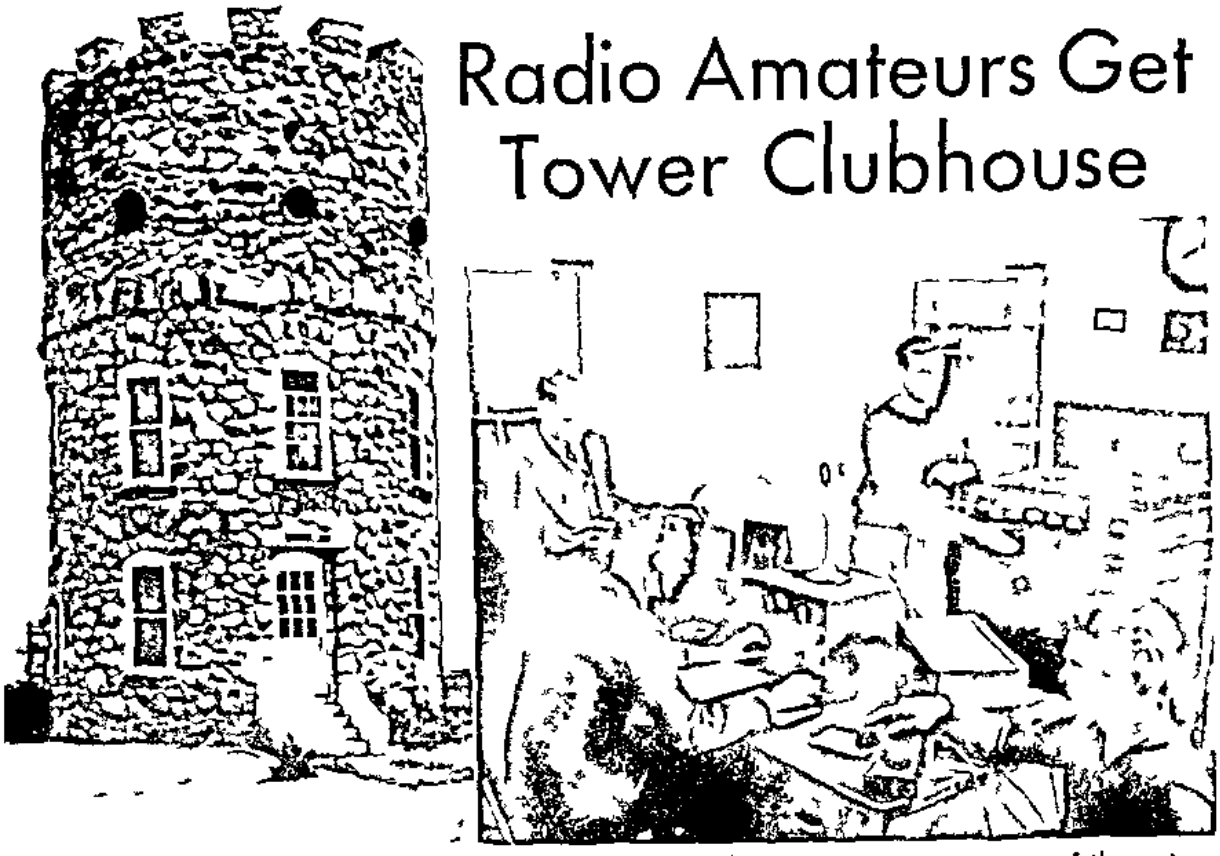


JUNKETING around the world for curios with plenty of time and means to enjoy his hobby, Harold W Smith has acquired an almost unbelievable collection for his Oceanside N Y summer home While he was at an oyster bar in a Richmond Va. hotel he relates an oyster was opened and a live sizable fish jumped out Smith obtained the fish and shell and had them mounted together Another of his prized oddities a disk shaped rosette of lead from a Civil War battle field is said to have resulted when a Union bullet and a Confederate bullet chanced to meet head on in mid air Hundreds of such strange objects as Zulu carvings a stone footprint of a prehistoric raccoon and copies of the world s fifteen most famous diamonds fill his museum His adventures on collecting trips include a descent into Vesuvius a ship mutiny a visit to African gold fields and a trek across Argentine pampas to the Andes



A fish found alive in an oyster shell is one of the oddities in the big collection of Harold W Smith of Oceanside N Y At the right the hobbyist is seen photographing a curiosity discovered on his travels at top with part of his private museum

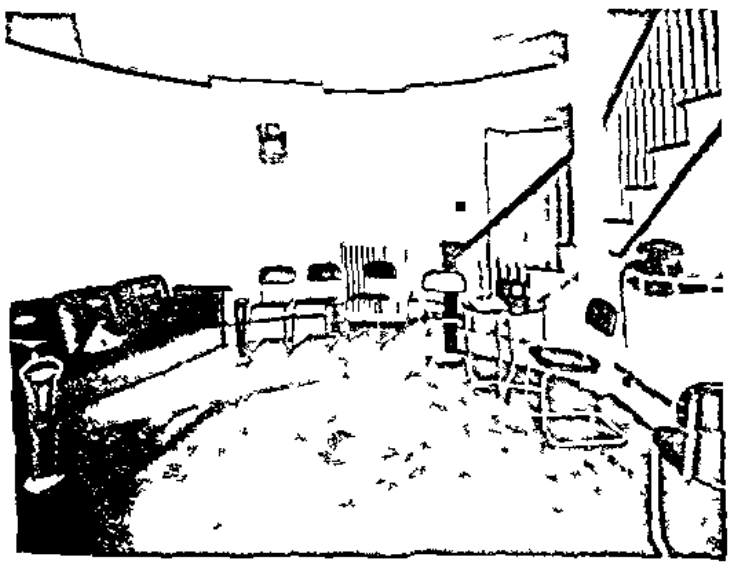
Radio Amateurs Get Tower Clubhouse



Manchester N H hams in the operating room of their city-owned radio station located in the old tower seen at the left

CONVERTED into an up-to-date radio station, an old stone observatory at Manchester, N H, now serves a threefold purpose As a public facility of the city its short wave outfit has been turned over to amateur radio enthusiasts, who have formed a club to share its use If an emergency such as a flood or hurricane cripples other communications the station will keep Manchester in touch with the rest of the country In the course of adapting the venerable landmark for these practical purposes, it has been renovated and preserved as one of the city s historical points of interest

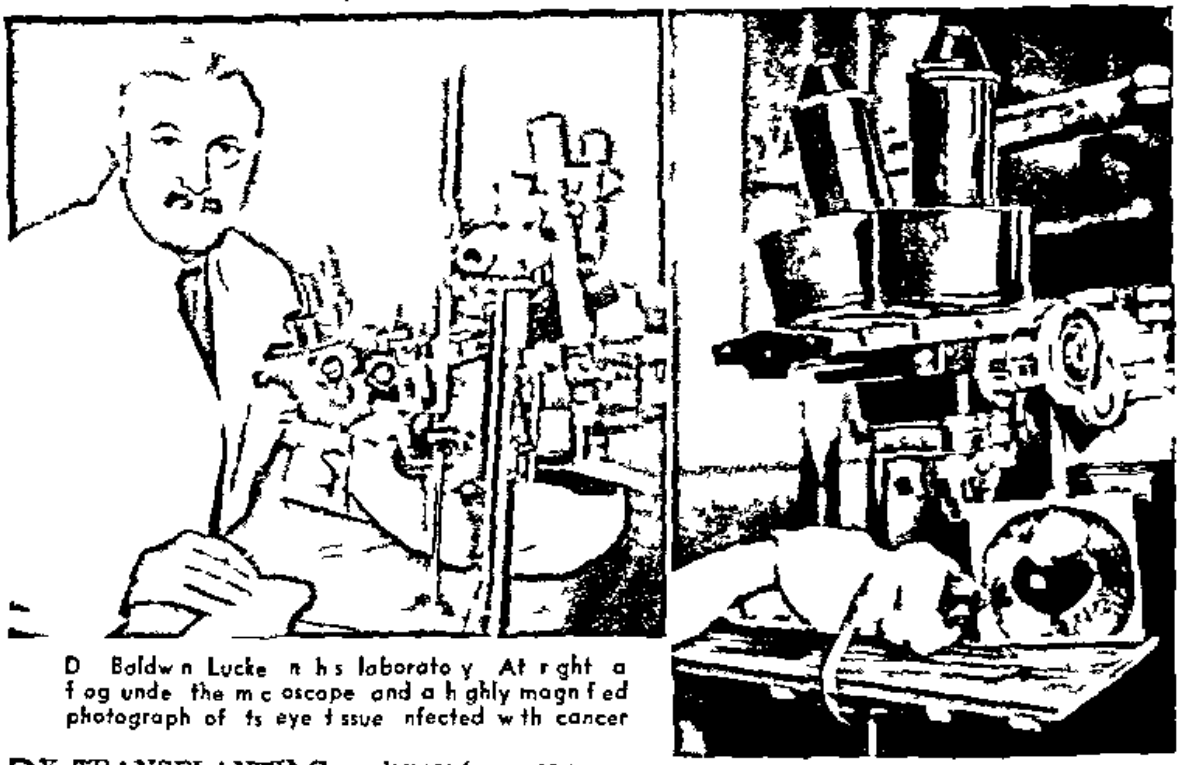
The first floor, attractively furnished as a reception room for visitors, also does duty as a clubroom for the radio 'hams" Their station with call letters W1LVK, occupies the second floor Its powerful transmitter and receiver cover all amateur frequency bands In case city power should fail a three-kilowatt, gasoline driven generator will operate the plant The top floor of the tower houses a workshop and experimental laboratory, and three sixty-foot poles, supporting an antenna, complete the installation



The reception room on the ground floor also serves as a clubroom

Built by a former governor of New Hampshire, the round tower was recently presented with its grounds to the city Public officials and leading citizens devised the novel plan of putting the relic to use, and their scheme was carried out with Government aid as a WPA project The eleven-acre grounds surrounding the tower have been made into a public park

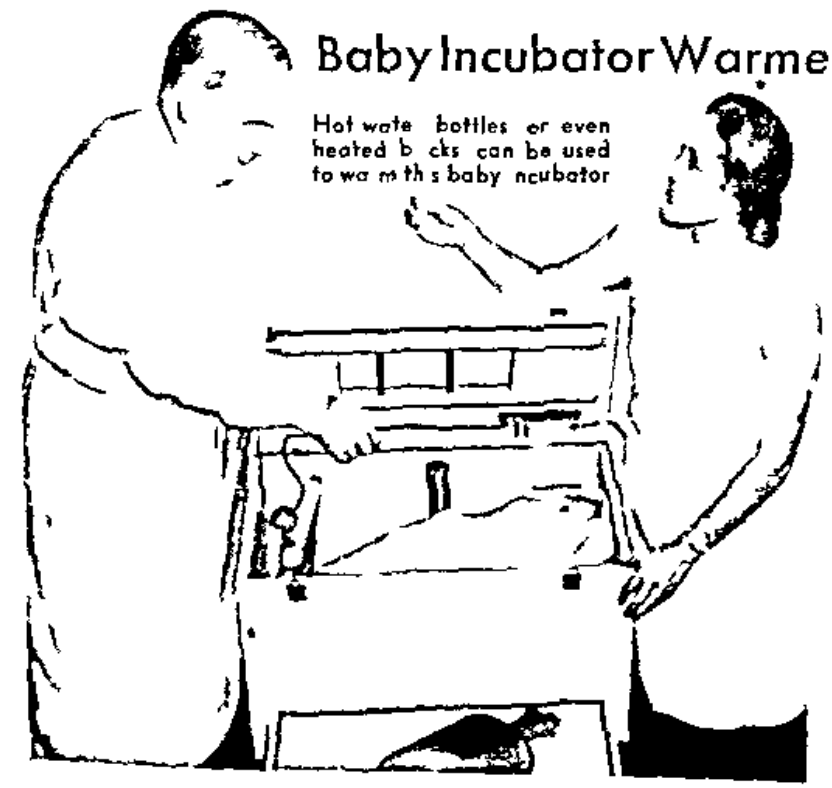
Tests on Frogs Show How Cancer Spreads



D Baldw n Lucke n h s laborato y At r ght a f og unde the m c oscope and a h ghly magn f ed photograph of ts eye t ssue nfected w th cancer

BY TRANSPLANTING malignant cancer cells to the eyes of frogs Dr Baldwin Lucke University of Pennsylvania patholo gist has found a promising new way to study their growth in normal tissue Period ic observations and photographs through a powerful microscope clearly show the prog ress of the disease in his animal patients. Resulting data may eventually prove useful in the treatment of human sufferers Al ready the tests are reported to have revealed well defined patterns previously unknown in the spread of cancer

Baby Incubator Warmed with Hot Bricks



Hot wate bottles or even heated b cks can be used to wa m th s baby ncubator

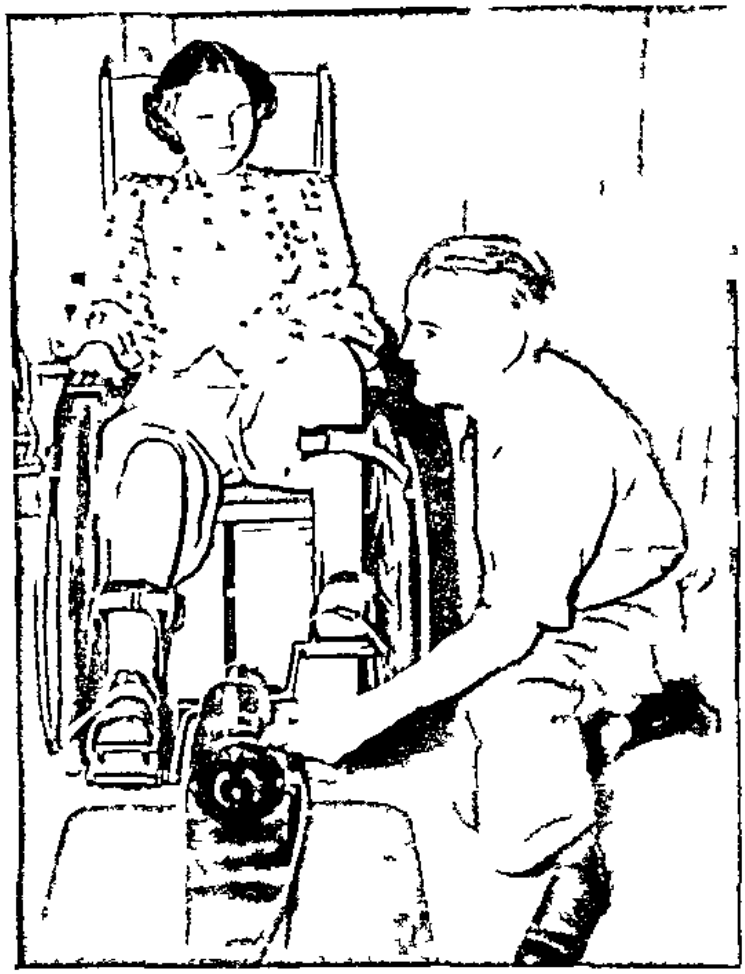
DESIGNED to serve equal ly well in primitive or modern surroundings a baby incubator of novel plan has been built by Na tional Youth Administra tion boys as a health proj ect for Chippewa County Wis Where current is available the chamber is heated with electricity regulated by a rheostat to give just the desired de gree of warmth In rural homes where electricity is lacking the incubator is kept warm by placing hot water bottles hot bricks or heated sandbags in a bottom drawer A ther mometer visible from the outside shows when it is time to renew the supply of heat.

Arteries Sewed with Sugar Rods as Darning Eggs

Rods of sugar may serve as darning eggs for sewing together the ends of ruptured blood vessels one of the most delicate of surgical operations After fulfilling its purpose the sugar would harmlessly dissolve Proposed by Sidney Smith Jr University of Chicago medical student the method is reported to have proved successful in preliminary trials upon animals Below Smith demonstrates his idea on a cut rubber tube



Sidney Smith Jr demonstrates his method of sewing up blood vessels

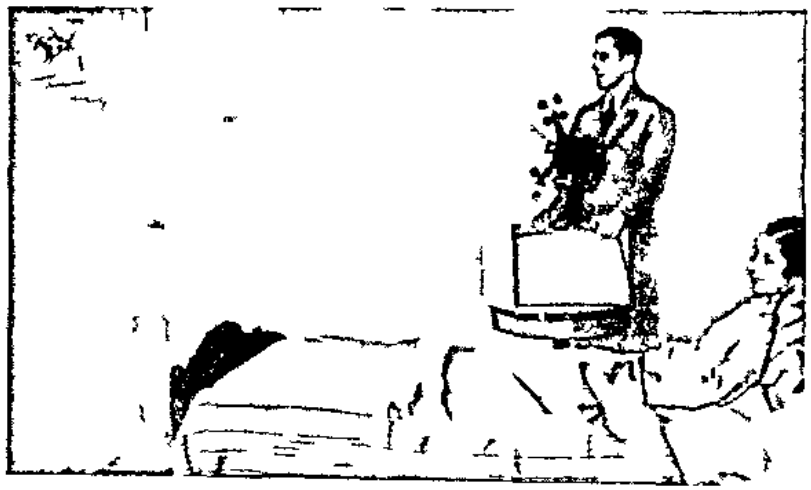


Exerciser for Paralysis Victims

After building seventy eight experimental machines to aid victims of infantile paralysis two brothers of Los Angeles Calif have perfected the electric exerciser shown above Legs and feet of the patient are strapped to pedals like those of a bicycle which are revolved in either direction by a reversible electric motor

Odd Service Brings Movies to Patients

A woman invalid's desire to see movies of the New York World's Fair suggested a popular and profitable service to a New York motion picture operator Now he brings his projector to bedridden patients entertaining them with film dramas or with travel pictures of places they would like to be able to visit For children his repertory includes animated cartoons



Magnetism Provides New Tests of Blood



D C D Coryell w th the appa atus used n magnet c blood tests R ght blood sam ple between poles of the electromagnet

BLOOD has surprisingly been found a magnetic substance by Dr C. D Coryell of the University of California at Los Angeles. Suspended between the poles of an intensely powerful electromagnet, a tubeful of bright red blood from the arter ies is repelled. Dusky-colored blood from the veins is attracted. Samples affected by carbon monoxide cyanides and other toxic agents differ in strength of attrac tion or repulsion which may be meas ured with delicate scales This "chemical analysis by magnetism offers a promis ing new way to study life processes and methods of combating poisons. So far Dr Coryell has tested twenty five gallons of beef blood and also some of his own.





Us ng the new v brator Inset shows four d sks

Multiple Electric Vibrator Massages the Scalp

FOUR hundred and eighty ar tificial fingers give the scalp a gentle and beneficial massage in a multiple electric vibrator just introduced. Light in weight, the appliance may easily be self manipulated as at left, with the aid of two convenient hand grips while four vibrating d sks do their work in unison The machine is said to stimulate the circulation of blood to scalp and brain cells and to remove all dan druff and loose hair

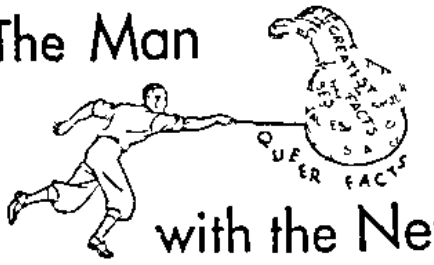
The Man  with the Net

PHOTO ELECTRIC *cells are used in a new device which is said to detect the approach of death by color changes in the skin*

AUSTRALIA'S *Great Barrier Reef has an area twice that of the State of Ohio*

SWALLOWING *occurs involuntarily in humans about once a minute*

NINETY FIVE PERCENT *of all the bathtubs in the world are in the United States*



BEES *roasted in oil and rubbed on the head once were thought to prevent hair from turning gray*

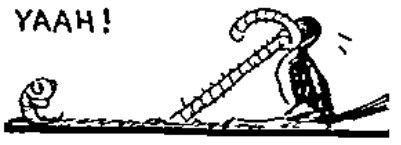
NATIONAL FORESTS *comprise almost one tenth of all the land in the United States*

REINDEER MILK *is richest of eleven types listed by the U S Department of Agriculture*



CURLING *tendencies in papers are now measured by experts at the U S Bureau of Standards*

EARTHWORMS *have 900 bristles on their bodies with which to anchor themselves in the ground when birds try to jerk them from their burrows*



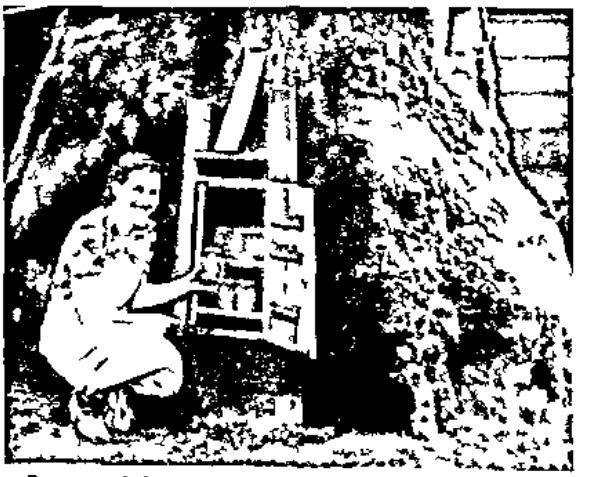


Fish "Talks" on Radio

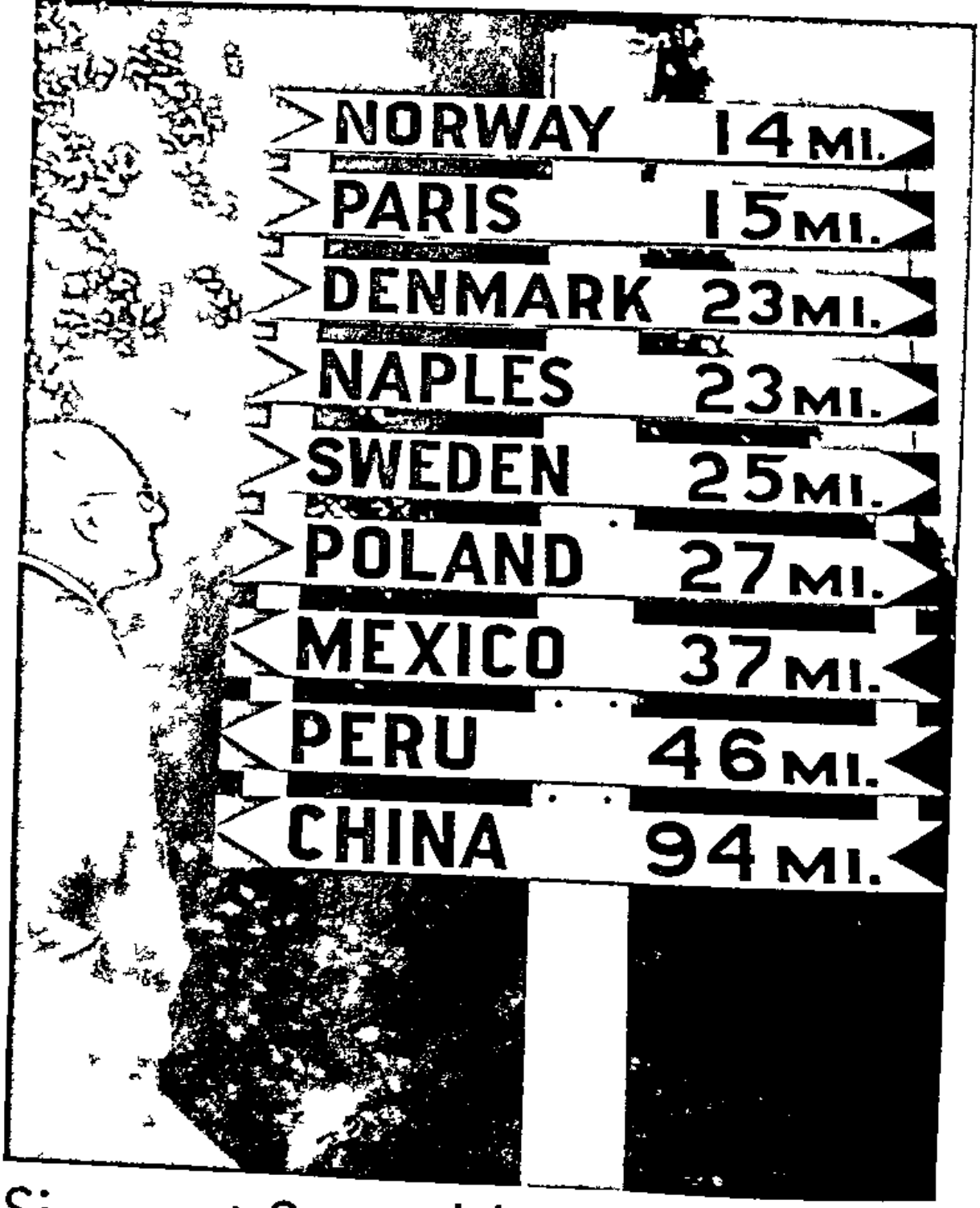
A TALKING CATFISH startled listeners to a recent broadcast from a New York City radio station When removed from his tank in the Staten Island N Y zoo, the conversational catfish a native of the Amazon region of South America made curious sounds into the studio microphone as part of a natural history program

Tree Serves as Cellar

MAINTAINING a temperature between forty and fifty degrees F the year round the hollow trunk of a huge maple tree serves as a fruit storage cellar for a Redmond, Wash family The tree cellar has room for 400 quart fruit jars



Preserved fruit is kept cool in this hollow tree

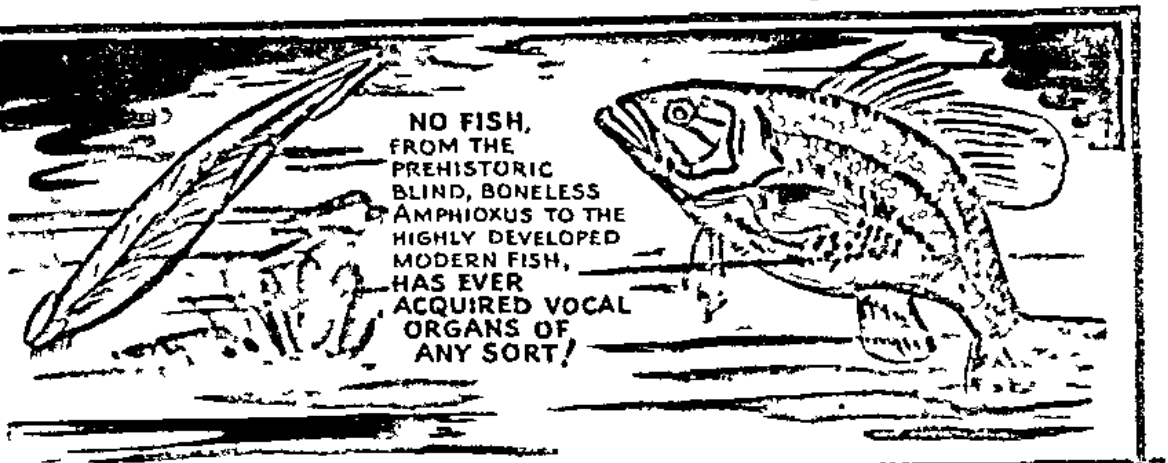


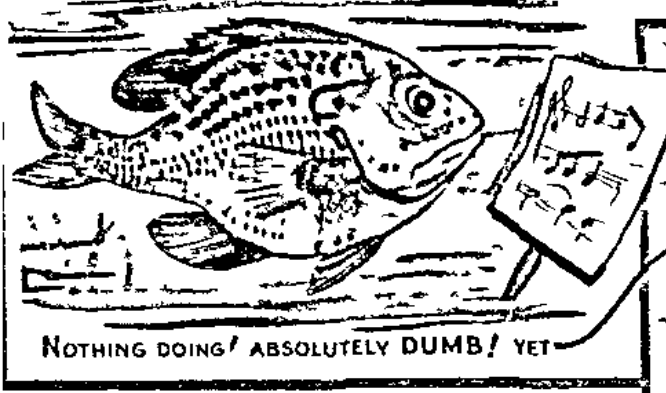
Signpost Scrambles Geography

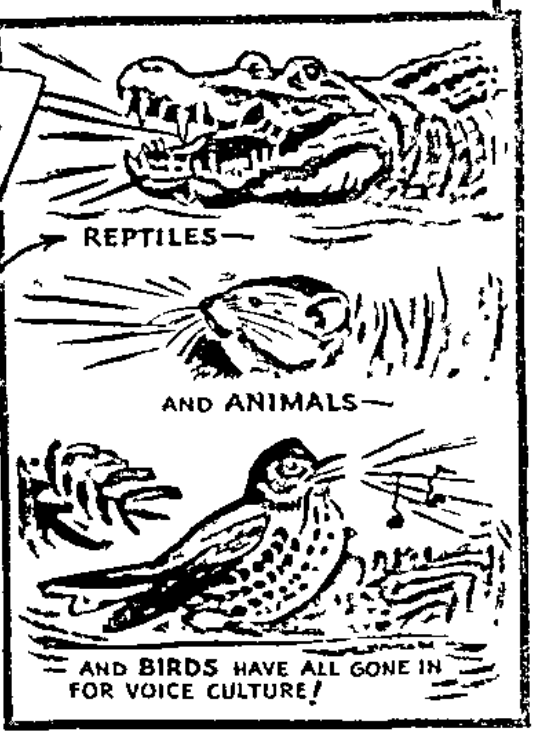
ARE you as puzzled over the s gnpost p c tured in the photograph above as is the somewhat amazed gentleman shown giving it his und vided attention? The odd high way marker strange as it appears is not the result of a map maker s n ghtmare It is an honest piece of work erected for the benefit of travelers along a motor road giv ing accurate nformat on concern ng the d rection and the mileage to the places named Where is the s gn located? P ck a spot twenty three m les from Denmark and still only th rty seven m les from Mexico and you have your answer G ve up? Well, it s at Lynchville Me and the local ties listed are all real Maine towns

Un-Natural History

By Gus Mager

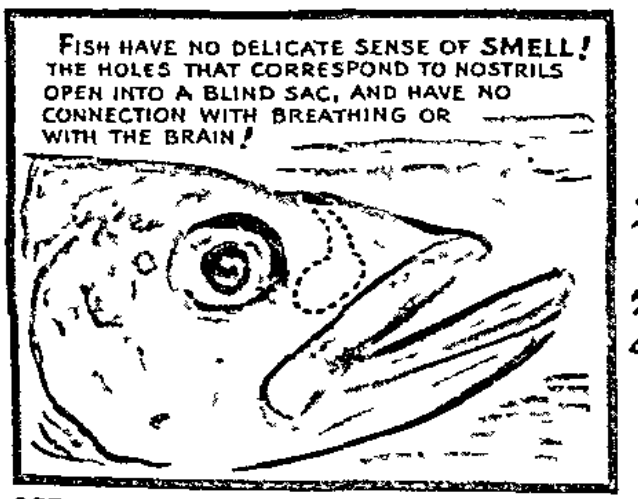


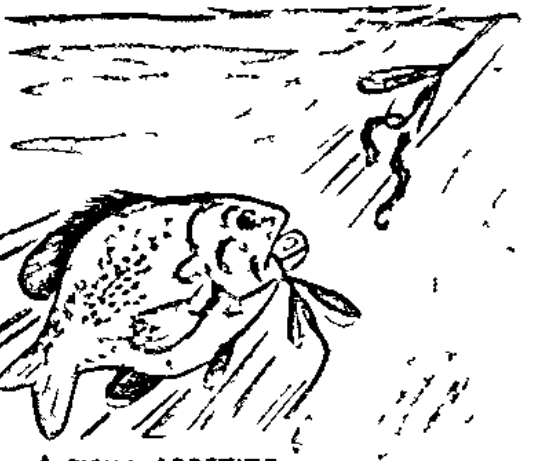






*NOR ARE THE EARS OF FISH OF ANY PRACTICAL USE, THOUGH FISH ARE EXTREMELY SENSITIVE TO VIBRATIONS!





A FISHS APPETITE SEEMS TO BE IN NO WAY AFFECTED BY ANYTHING AS TRIVIAL AS A HOOK OR TWO IN HIS MOUTH!



Curtain Vases Hold Flowers

DRAPERIES ornamented with real flowers instead of floral designs, have been introduced by a New York interior decorator. Pockets in lower folds of the curtains conceal test tubes filled with water into which cut blooms may be slipped as illustrated in the photograph above. The result is a gay fringe of blossoms to brighten a room with color.

Greaseless Liquid Waterproofs Cloth

POSITIVE waterproofing is claimed for a new liquid preparation which, according to the maker, contains no grease or oil. Of special interest to outdoorsmen, the compound will make clothing, shoes and tents impervious to moisture. It may also be used upon automobile tops and tarpaulins. Objects to be waterproofed must be thoroughly clean and dry. The fluid is applied by rubbing with a cloth moistened in it.



Clothing can be waterproofed by rubbing it with a cloth moistened in the new compound

Funnel Treatment Inoculates Trees Against Disease

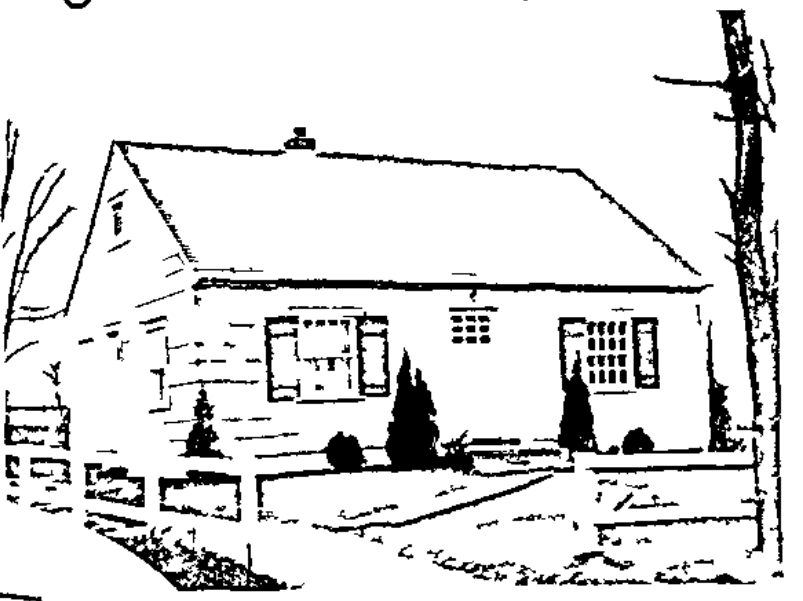
LIKE human beings, trees can now be inoculated against disease. The new method employs a funnel that is placed around the trunk and filled with a chemical solution. When holes are bored in the tree's bark, the chemical mingles with the sap. The illustration at right shows how the method is used to prevent infection of a tree with the destructive Dutch elm disease or to kill any fungus already there. A major problem was how to make the funnel water tight. This was solved by lining the base with a sheath of special material which fills the bark crevices to provide a leakproof seal.



A chemical solution in the funnel mingles with the tree's sap

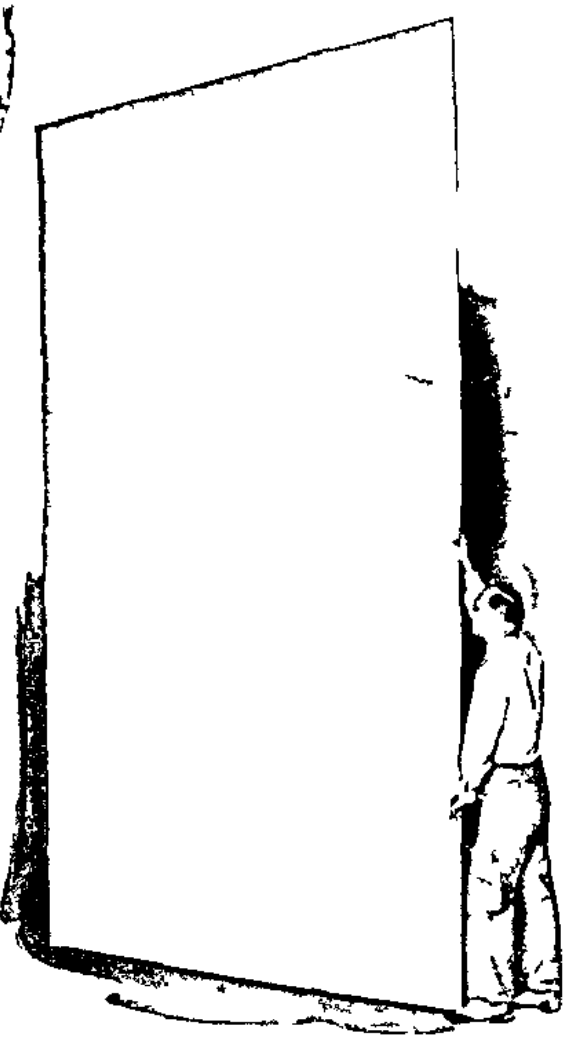
Newlyweds' Bungalow Costs Only $2,650

DESIGNED especially for newlyweds a model bungalow erected with Federal aid at Chester Pa. is the forerunner of hundreds like it Costing only $2 650 the house can be bought with a down payment of $150 and monthly payments of $20 90 It has a *good size living room* shown in the photograph reproduced below two bedrooms kitchen bath and ample closet space



Model home designed for young married couples It has an ample living room (left) two bedrooms kitchen and bath





Giant Wall Board Covers Whole Side of a Room

WALL BOARD of giant size so large that a single panel covers an entire wall without cracks or joints now is available for time saving dry built construction It comes in sheets up to eight by fourteen feet To the smooth plaster surface the manufacturer adds a size or primer so that it can quickly be finished after erection with one or two coats of paint

Bulb Gives Bright Light

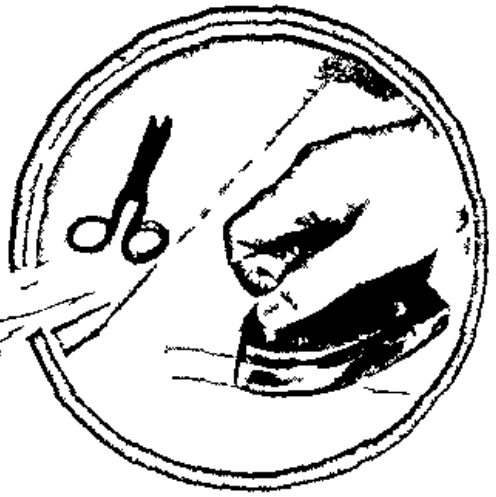
ELECTRIC LIGHT bulbs that give a brilliant white light are made possible by a new manufacturing process Tiny wire brushes mounted on the filaments enable the new lamp to operate at higher temperatures than ordinary bulbs without burning out as vaporization takes place at the brush tips rather than in the filament

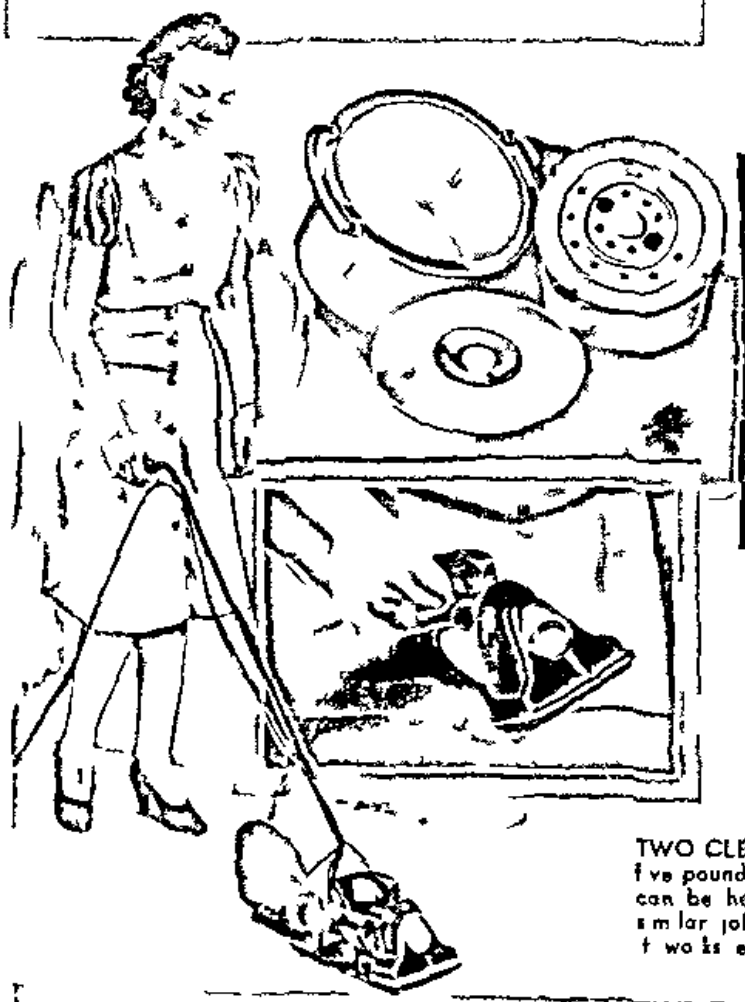


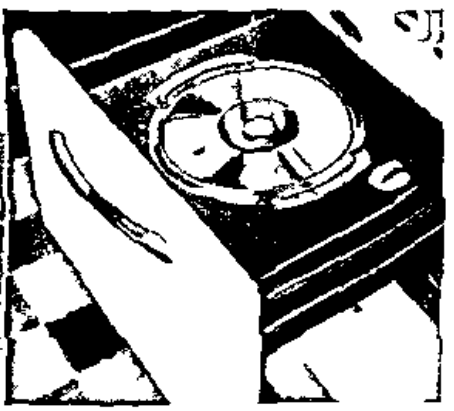
WATER OZONIZER. Tap water that has unpleasant taste or odor s made palatable by an electr c de- v ce connected to the faucet When water is tu ned on pu fy ng ozone s generated and m xed w th t

MENDING TAPE FOR LINEN

To n sheets p llowcases sh rts and other art cles can be mended eas ly w th a new tape wh ch s pressed onto the fabr c w th a hot iron S nce t conta ns no latex rubber the tape is not affected by dry clean ng chemicals





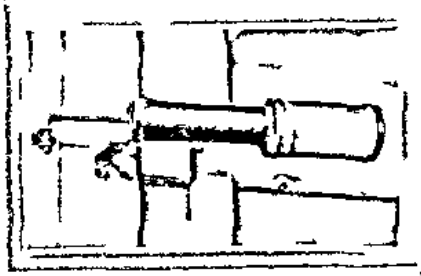


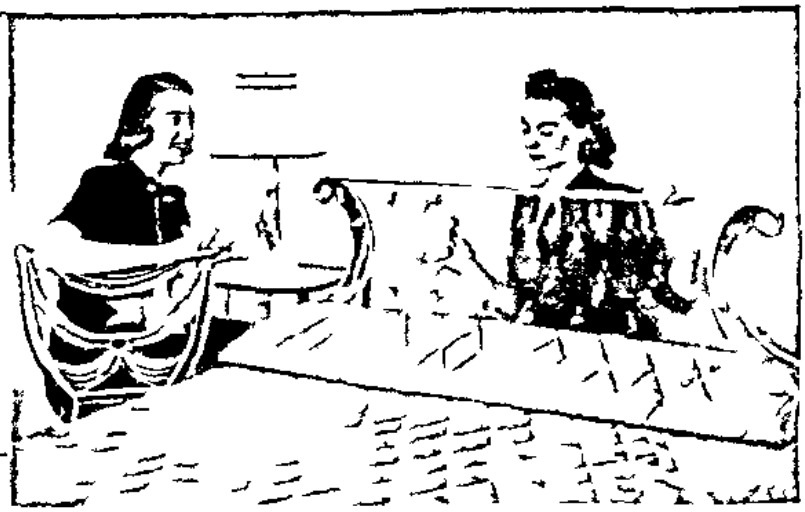
DEEP WELL COOKER Among the novel features of a new elect c range s a deep well cooker bu lt nto the range top as shown at upper left In one model the s x qua t cooker un t s set nto one of the la ge ut l ty d awe s at the range as seen above

TWO CLEANERS IN ONE We gh ng only f ve pounds the vacuum cleaner at the left can be held n the hand for dust ng and s m lar jobs F tted nto a spec al f ame t wo ks eff c ently on floo s and carpets

Nine Handy Aids

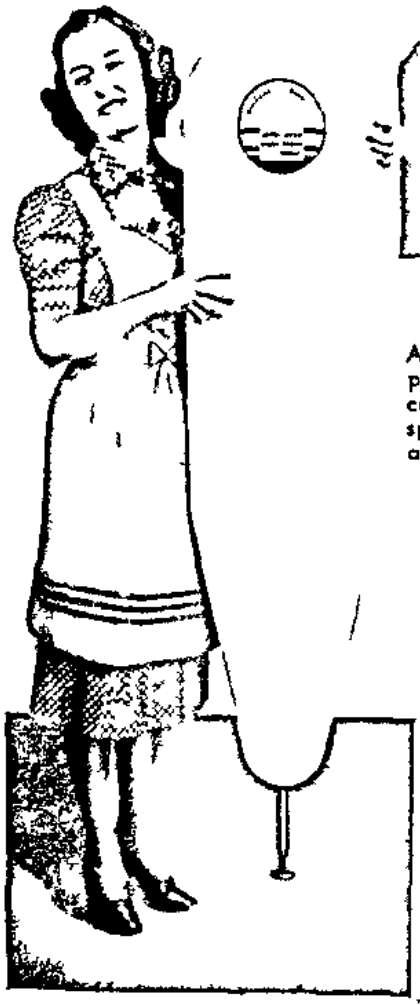
MOTH KILLER Eve y t me the closet door s closed a plunger n the f xtu e below fo ces a r th ough a perfo ated chambe to sp ay the nte o w th a chem cal that de t oys moths

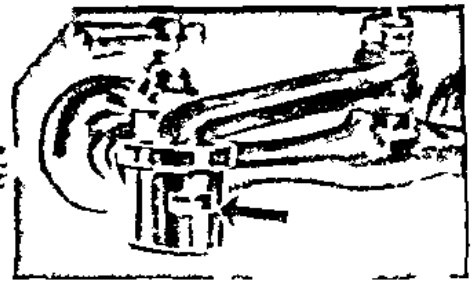




METAL IRONING BOARD
L fet me serv ce s cla med fo the a metal on ng boa d I *lustrated below* Vents n the top ca y off the excess steam

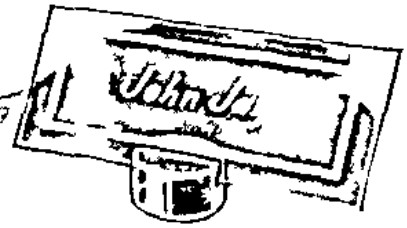
TRANSPARENT FURNITURE Th s bed and cha are made of a crystal clea pla t c that does not ch p spl t or sta n

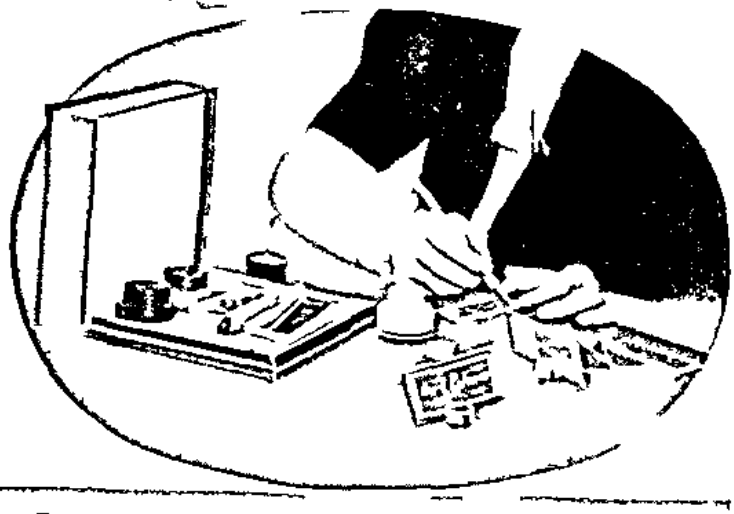




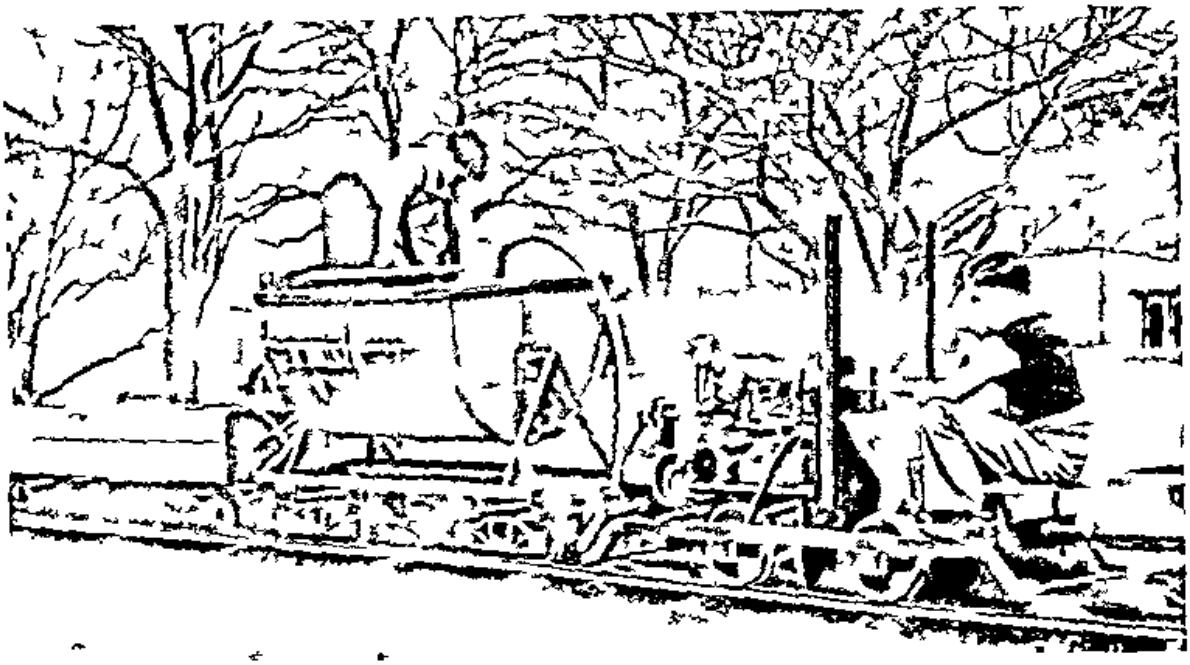
TAP THERMOMETER
How hot s you hot wa ter? Th s faucet the mom ete w ll tell you An nd cator panel changes color to show f t s too cold too hot o as you want t

PLACE CARD OUTFIT
Att act ve place ca ds a e p epa ed w th ths k t It conta ns celluto d str spec al nk for ma k ng and stands to hold them up



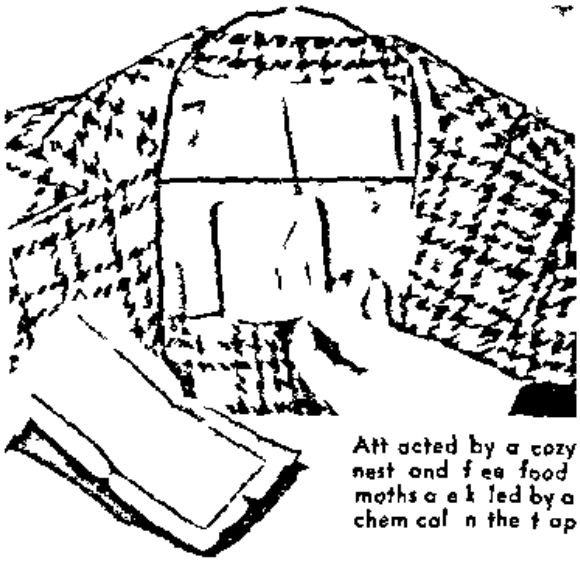


for the Homemaker



Orchard Railroad Aids Peach Grower

LEO HERMAN of Tallmadge Ohio started his 2 500 foot electric railroad system as a hobby but now it helps him to care for an extens ve peach orchard on a six acre tract surround ng his home An electric loco motive pow ered from a third rail hauls the rolling stock of four cars—two flat cars for carrying passengers tools and equip ment one specially built to haul spray hose and a tank car for the liquid spray



Att acted by a cozy nest and f ee food moths a e k led by a chem cal n the t op

Moth Trap Lures Pests

INSTEAD of em tting an odor unpleasant to moths and merely driving them to an other spot, a new moth trap lures the cloth destroying insects to their death. Clipped to a clothes hanger the cardboard trap provides a convenient nest with food for the moths A chemical in the trap kills moths larvae and eggs

New Concentrated Soup Is Easy To Prepare

DELICIOUS soups are now available to house wives in convenient concentrated form The concentrate is removed from its package crumpled and dropped into a quart of boil ing water as shown below In a few minutes a tasty and nourishing soup is ready to serve



Crumbl ng concent ated soup nto bo l ng water



When look ng stra ght ahead how well do you see to e ther s de? W th a pe meter the seated man s hav ng th s v tal factor to good d v ng measu ed



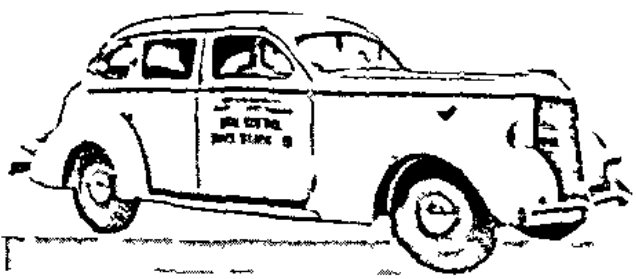
A hea ng test The same volunteer is followed through out most of the p ctures on th s and the next page He e h s response to sounds of vary ng intens ty is checked

Odd Driving Tests

SEEK THE CAUSES OF AUTO ACCIDENTS

WHAT are the real causes of auto mobile accidents? In an attempt to shed further light on this com plex problem the Center for Safety Educa tion of New York University in coöperation with the State Motor Vehicle Bureau and the Greater New York Safety Council recently inaugurated an elaborate series of special tests for volunteer groups of metro politan drivers

Twenty five automobile operators each of whom had driven at least 50 000 miles in the metropolitan area during the last five years without a single accident form the first group tested while a second group of twenty five were picked from those who in the same five year period had been in

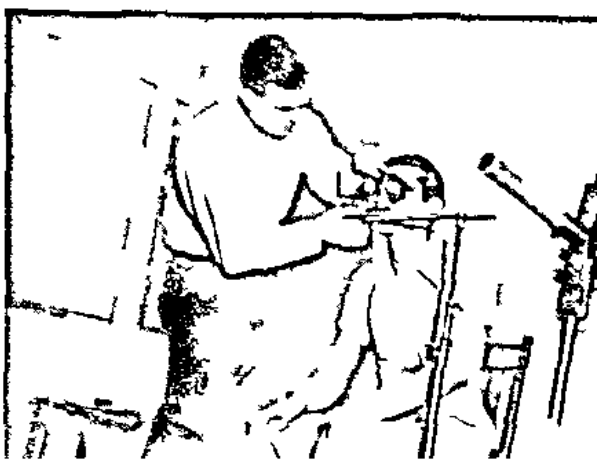


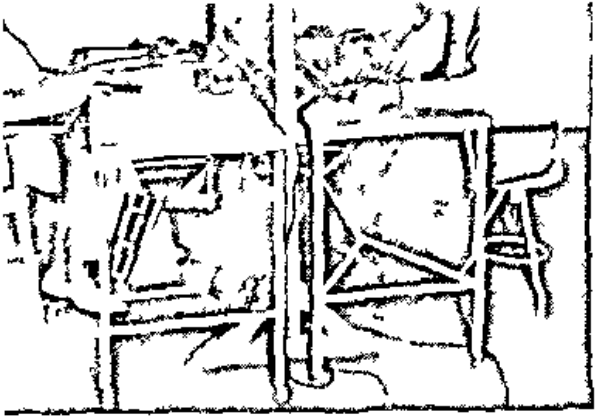
In the dual cont ol car at left road tests show up h s sk ll or lack of t

The d ver now looks at a br ght l ght ins de of an adaptometer Temporar ly bl nded he must be able to see normally aga n w th n a spec f ed t me

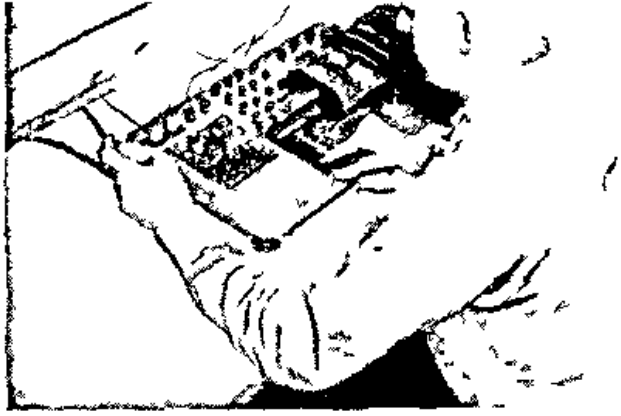
Aga n the d ver s eyes a e tested th s t me for v s on under va ous l ght ntens t es to learn whether or not he s sub ect to any n ght bl ndness



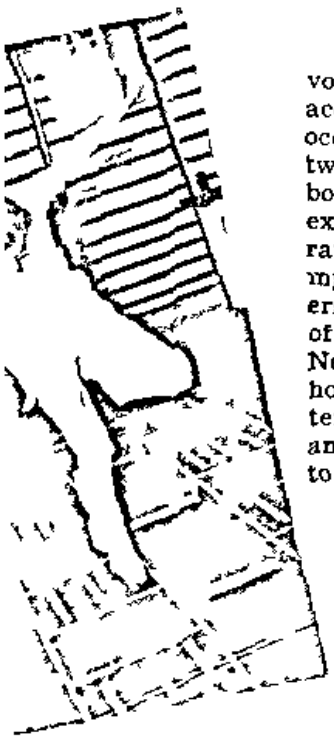




Test ng phys cal eaction The examiner controls a buzzer and a l ght As soon as he operates either driver screened from h m must let up telegraph key



Timing of the driver s reaction speed as tested at the left is done by the examiner w th this appara tus which measures delays to one 300th of a second



volved in at least four accidents one of which occurred within the last two years By putting both groups through an extensive series of labo ratory and actual driv ng tests the researchers under the direction of Dr Leon Brody, of New York University, hope to be able to determine what physical and mental factors tend to make good drivers

To show muscular reactions driver holds his left foot behind him w th h s r ght hand as he hops through intri cate system of squares

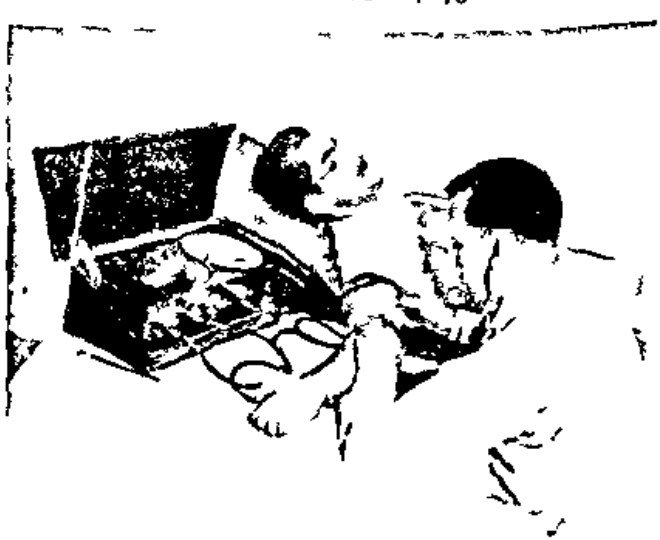
In specially equipped laboratory rooms each driver is tested for blood pressure muscular coördination speed of reaction to sound and light vision and muscular con trol of the eyes and other physical factors An impressive array of instruments in cluding a dynamometer, manoptoscope adaptometer, and other scientific measuring instruments is employed

In a second group of tests, the subjects are sent out on the city streets in dual control automobiles for actual driving tours An accompanying observer rates the car operator s driving ability with the aid of a scale chart designed expressly for the pur pose The third part of the complete test series involves written examinations given to check on matters of the subject s personality and general intelligence, as well as on his driving attitude and knowledge of the principles and practices that contribute toward making a person a good driver

Test ng a driver on the road Given a driving com mand he waits to obey it unt l the examiner flashes a dash l ght H s react on t me is again recorded

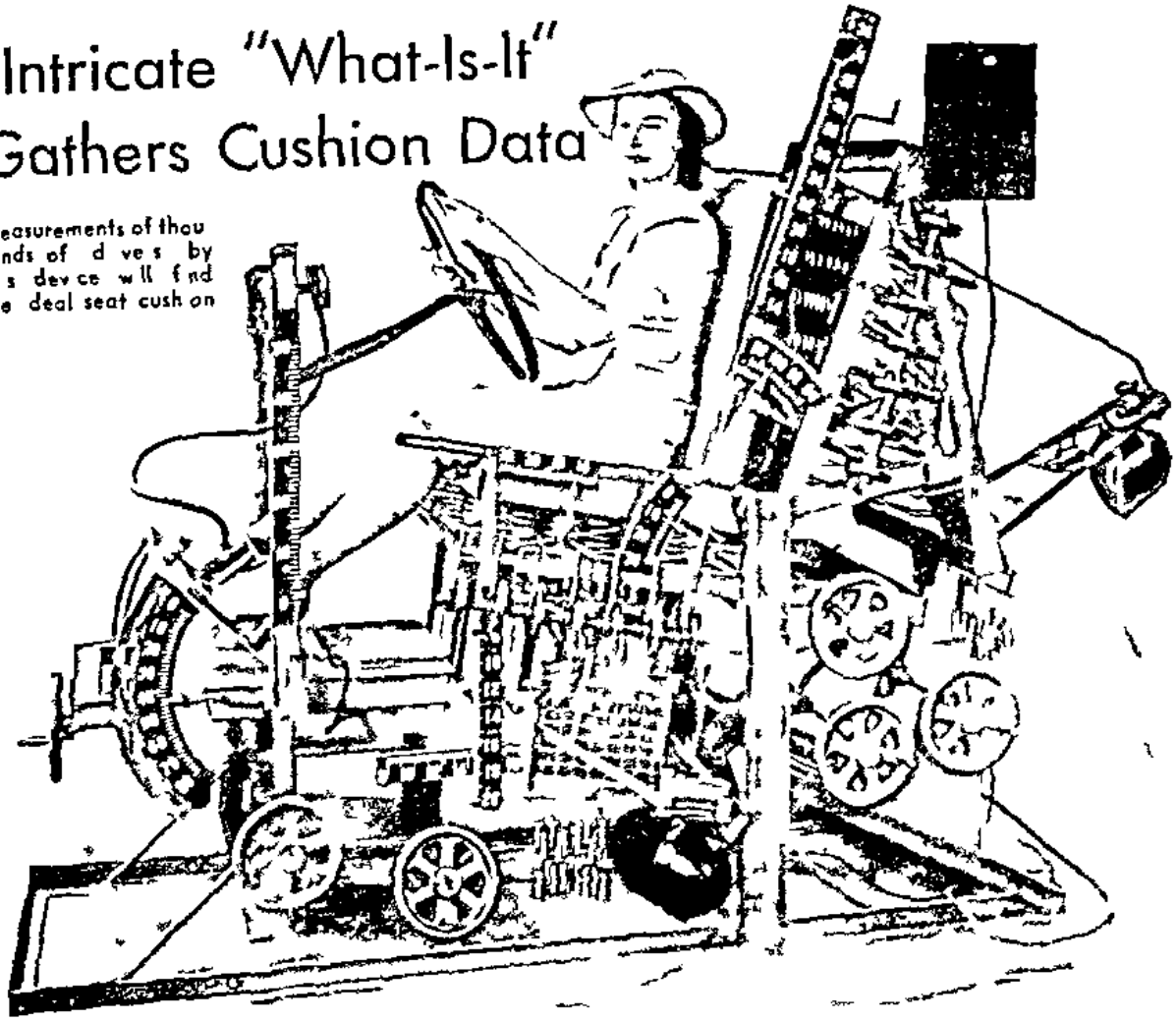
Brief fluctuat ons in blood pressure arising from var ous driving experiences are measured as below with a del cate device called a sphygmomanometer



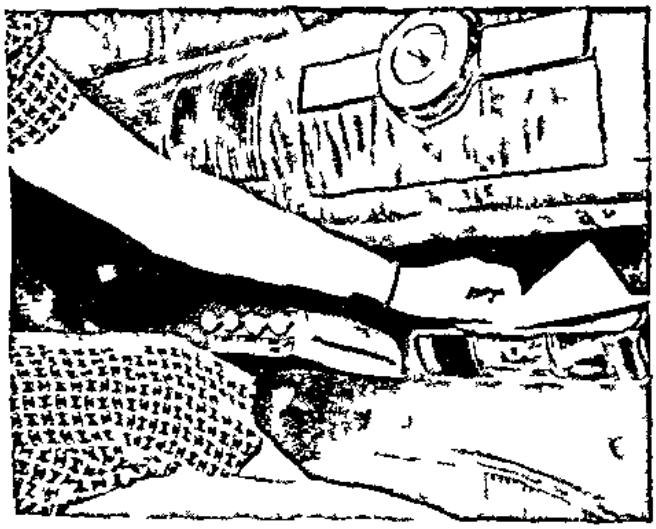


Intricate "What-Is-It" Gathers Cushion Data

Measurements of thou sands of d ve s by th s dev ce w ll f nd the deal seat cush on



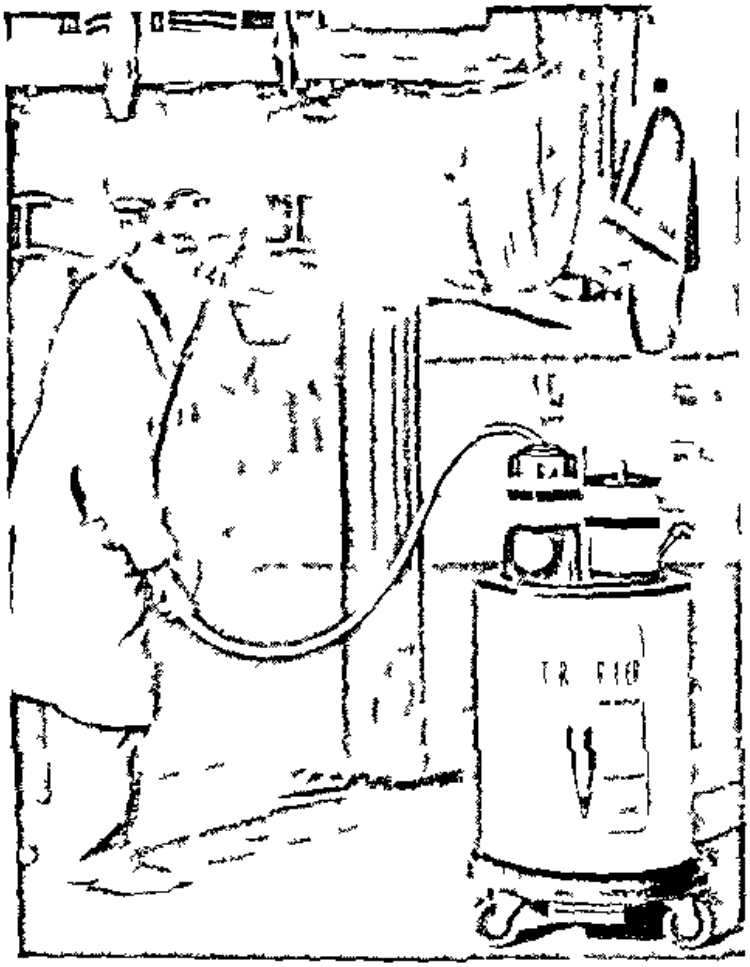
NO it s not a car of the future nor the past either The strange looking con traption in which the young woman seems to be going for a drive is designed to gather information for engineers Installed at the University of Michigan at Ann Arbor where thousands of persons have sat in it, the apparatus was built for a cushion man ufacturer who hopes from countless meas urements made on it to obtain an average size automobile seat cushion that will be comfortable for the majority of motorists.



How the cleans ng t ssue d spenser fastens under the dash

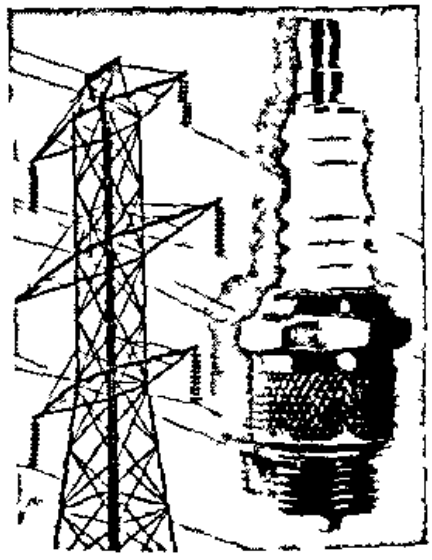
Dash Dispenser for Cleansing Tissue

FACE CLEANSING tissues ideally suited for innumerable driving uses are stored in a convenient dispenser which fits under the glove compart ment of the dashboard of one new model car Finished to match the instrument panel the dispenser is offered as an inexpensive optional accessory to buyers The tissues are handy for dusting and polishing win dows steering wheels and instru ments They also are a convenience as emergency handkerchiefs for suf ferers from colds and hay fever and other motoring needs



Spark Plug with Skirts Prevents Short Circuits

LONGER trouble free life is claimed for a new spark plug which represents according to its makers the first major advance in plug construction in more than a decade Taking its cue from the skirted insulators that carry cross country high tension wires the porcelain insulator sleeve of the plug is ridged by petticoats which decrease accumulation of dirt and grease and increase surface area lessening the chance of short circuiting

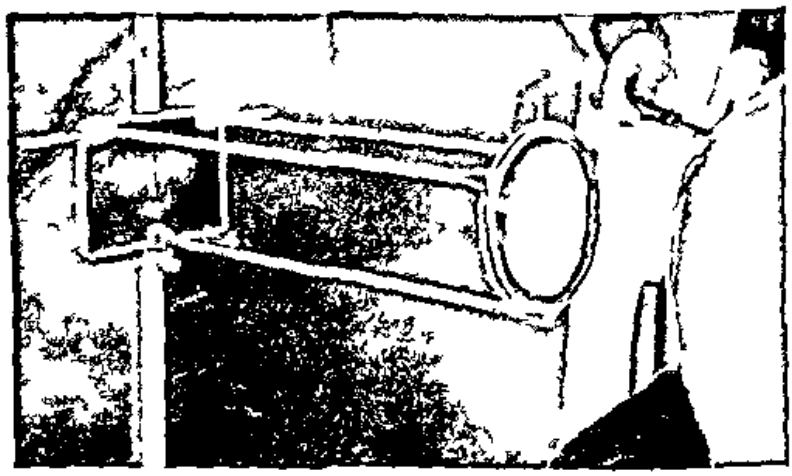


Hot-Oil Flusher Cleans Gears

MOUNTED on casters an oil heating and pumping machine for garage use flushes automobile transmissions rear ends and crankcases with a flow of thin oil heated to 220 degrees F to remove all traces of dirt sticky sludge and metallic fragments Oil pumped by the device is sucked back again to boost the cleaning process

Headlight Aimer Saves Time and Space

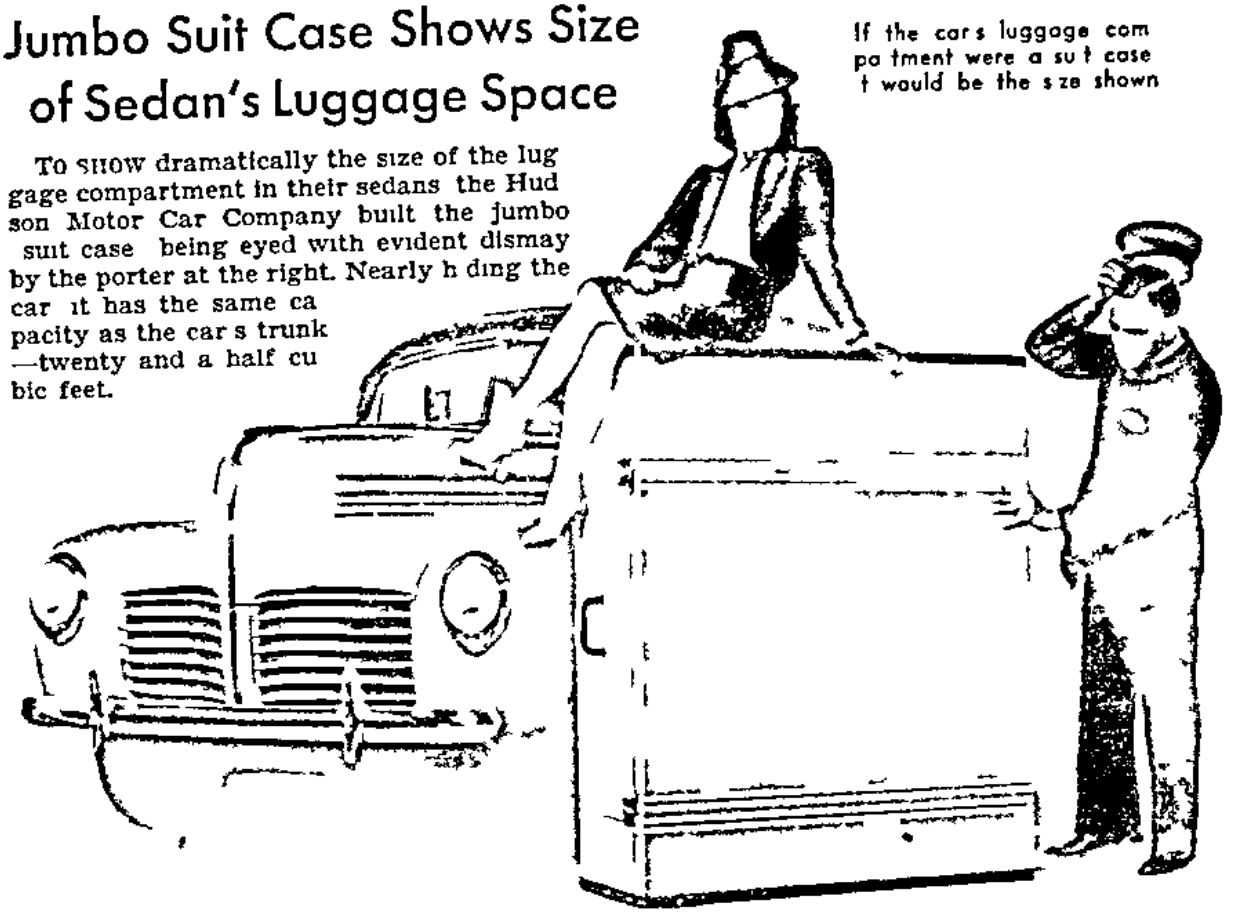
AN OPTICAL TYPE headlight aimer using a reducing lens to focus the light beam on a midget calibrated screen saves both space and working time Usually car lighting testing jobs require up to twenty five feet of clear space and a large target The new instrument requires only four feet in front of a car Suitable for any type of headlight the device permits both vertical and horizontal adjustment It is also available with a light intensity meter



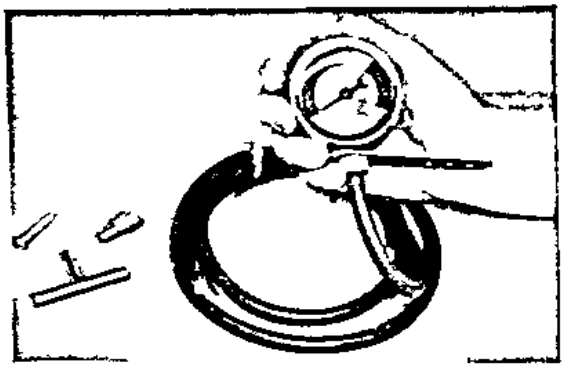
Four feet of space instead of twenty five suffice for this tester

Jumbo Suit Case Shows Size of Sedan's Luggage Space

To show dramatically the size of the luggage compartment in their sedans the Hudson Motor Car Company built the jumbo suit case being eyed with evident dismay by the porter at the right. Nearly h ding the car it has the same capacity as the car s trunk —twenty and a half cubic feet.



If the car s luggage compa tment were a su t case t would be the s ze shown

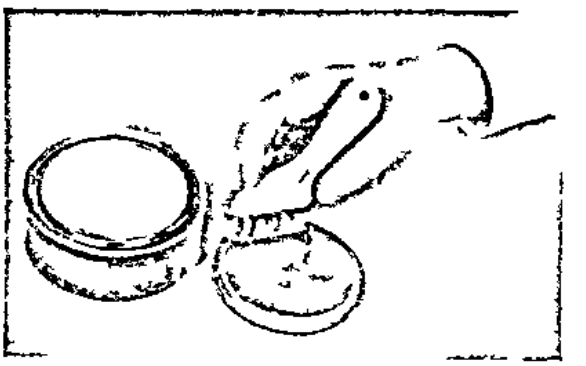


Meter Helps Car Driver Cut Fuel Consumption

How to press the foot accelerator of your car for the greatest gasoline economy under all cond tions of driving is indicated instantly by the meter shown above Easy to install on the dash or to fasten in place by a windshield mold ng screw the instrument has a pointer which indicates whether gasoline consumption is low medium or high By observing when the consumption is high a driver can keep from wasting gasoline The device also indicates the proper fuel consumption for coasting and idling as a check on motor adjustment

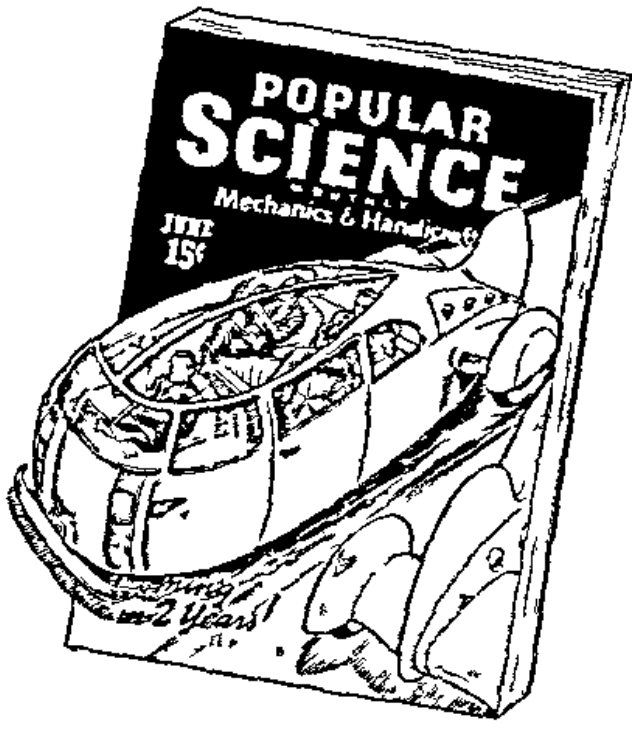
Handy Brush and Cleaner for White-Wall Tires

FREE of any bleaching agent or ingredi ents harmful to rubber a new preparation just placed on the market for motorists removes dirt grease and scuff marks from white walled tires at the same time that it applies a fresh white coating The manufacturer claims that the finish will neither crack nor peel off The compound is packed in thirteen ounce tins as shown in the illustration reproduced below and a special cleaning brush with a convenient handle and fine brass wire bristles comes with it.



Brush and cleaner set to keep wh te t res spotless

Auto Contest Winners



POPULAR SCIENCE READERS AIR THEIR "PET IDEAS" ON THE CAR OF TOMORROW

SIXTY FOUR PERCENT or nearly two thirds of the POPULAR SCIENCE readers who submitted letters in the Car Design Contest announced in the June issue believe that the proper place for car motors is behind rather than in front of the car's occupants

Added to this startling majority is the preference of forty percent of the contestants for a car of functionally streamline "teardrop" design.

In each of the percentages given the figures represent nearly a unanimous opinion of all who expressed their ideas on those points with scarcely a handful opposing such drastic changes

From bumper to bumper cars of the *past, present,* and *future* were appraised by the entrants in the contest, the winners of which, along with those who received honorable mention, are listed on this page For the most part, the writers agreed that cars should not be larger lest they outgrow private garages and, as one pointed out, "it's easier to change America's cars than her garages

A teardrop car incorporating the various ideas suggested by the many contestants would have an underside as smooth as the rest of the body and windows of transparent plastic would be flush with the body panels to cut down wind noise and resistance. The bodies of one piece metal reenforced plastic would be so strong as to dispense altogether with the present day chassis while the engine transmission fluid type clutch, drive shaft, rear axles, and wheels all built as one easily removed unit, would be light and economical to maintain

Many letters approved fluorescent lighting both inside and out, with all exterior lights recessed in the body and fenders Sliding doors controlled by push buttons would replace the hinged doors of today The driver's seat, holding two or more people would be close to the wide unobstructed windshield, and ahead of the front wheels. Extending fully around the car would be a rubber and steel bumper of standard height.

FIRST PRIZE, $50

Wyatt Brummitt Pittsford N Y

SECOND PRIZE, $25

Herman Schepler Dubuque Iowa

THIRD PRIZE, $15

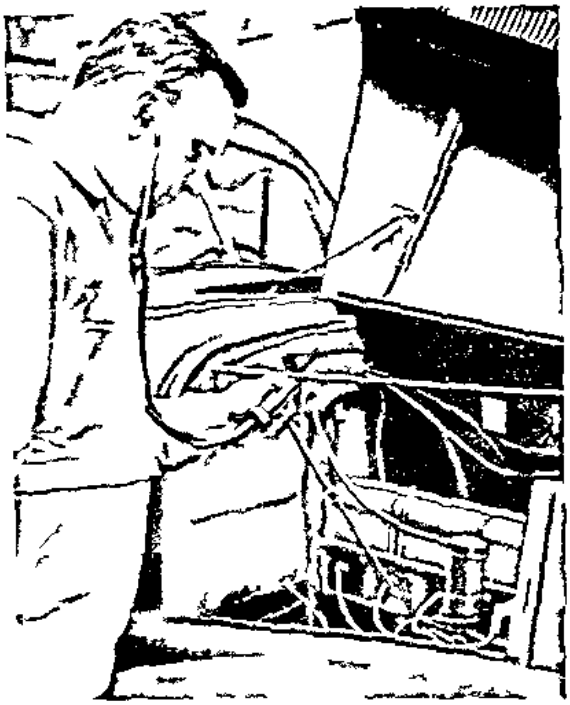
W H Kindel Pueblo Colo

FOURTH PRIZE, $10

Floyd Milton Worthington Minn

HONORABLE MENTION

Clifford Blanke Los Angeles Calif Don W Byers Minneapolis Minn Andrew P Fischer Delano Calif P McCormick Henry East Falls Church Va J Melenick Winnepeg Manitoba Canada W Ward C. Rond Kansas City Mo; Robert R Soone Rochester N. Y; Ralph G Young M.D Long Beach Calif

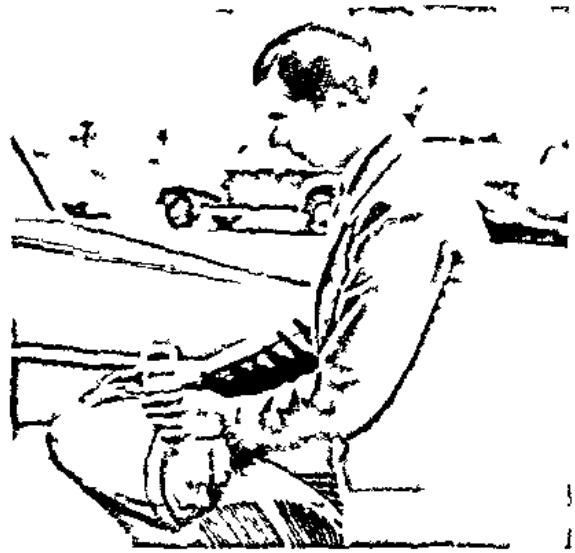


Mechanic's Stethoscope Diagnoses Auto Ills

RESEMBLING a doctor s stethoscope a handy new tool enables the automobile mechanic to diagnose car ills Consisting of a length of rod and rubber tubes leading to earpieces the device is pressed against a spot on a motor clutch transmission or rear end near where the trouble is thought to be It quickly locates knocks and squeaks

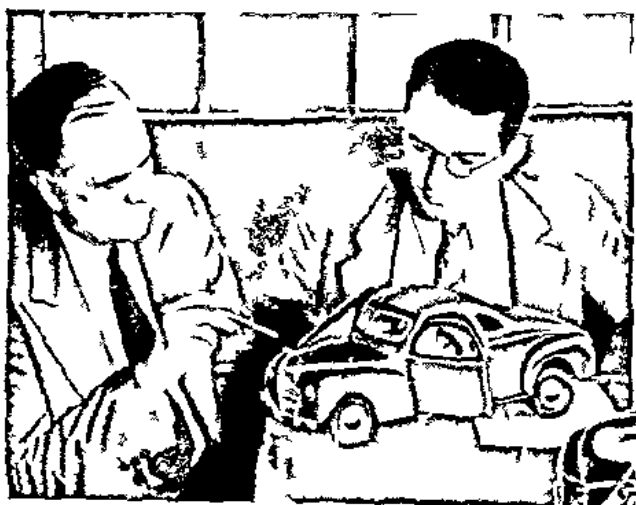
Cleaner Takes Bug Stains from Automobile Finish

LATE SUMMER drivers will welcome the cleaning compound shown in use in the picture below for cleaning dried bugs and bug stains from the fenders radiator grilles windshields windshield frames and other parts of the car It contains a chemical com pound that reacts quickly on bugs without harming the car finish To use the cleaner the surface to be cleaned is first wet with water The powder is then sprinkled from its shaker top can on the stained area rubbed with a damp cloth and rinsed off



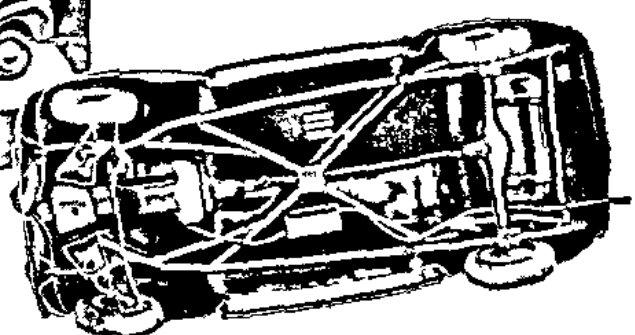
The bug remover s s mply rubbed on w th a cloth

Owner Builds Working Model of His Car

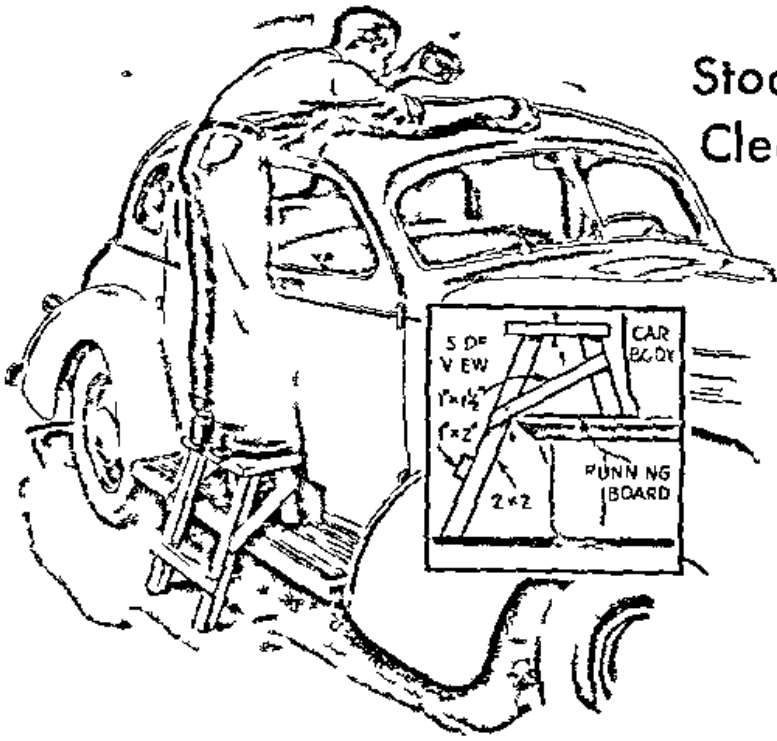


Two apprec at ve experts—G B Allen ch ef eng nee and A H Fr es ass stant ch ef engneer of the Dodge D v s on Chrysler Cor po at on— nspect ng the scale model coupe

REPRODUCING practically all operat ing parts with such precision that they function perfectly the model of a popular stock model coupe shown in the accompanying photographs was copied from his own car recently by Philip Johnson, of *Vermillion* S Dak Individual front springs clutch brakes gearshift engine fan venti lators windows hood and doors all operate realistically

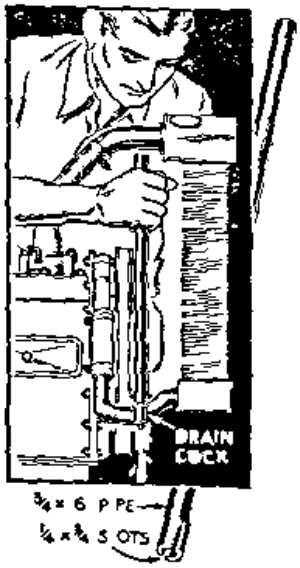


REPAIR STUNTS



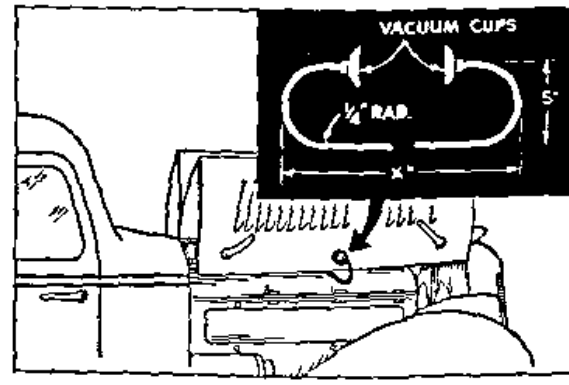
Stool Gives a Lift for Cleaning Top of Auto

IF YOU ever tried to balance on the running board of your car while washing or polishing the top you'll appreciate the usefulness of the stool shown in the accompanying sketch. It can be made easily from a few pieces of wood the dimensions of which are suggested in the drawing. The length of the legs of the stool should be determined by the height of your running board and your own height. Be sure to make it high enough to allow you to reach a little more than half way across the car top from either side without stretching. —F. G.



Slotted Pipe Easily Opens Radiator Drain

RADIATOR draining is made easy with a section of ¾" pipe 16" long and slotted at one end as shown at the left. The pipe is easy to lower over the usually inaccessible petcock to open or shut it. It will save scratched hands and spotted sleeves—to say nothing of tempers.—V. C.

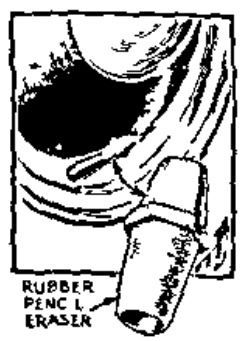


Bracket Holds Both Sides of Car Hood at Once

IT IS often necessary to hold up both sides of an old style car hood while doing minor repair jobs but they will not always stay put. A useful holder can be made from a ¼" pipe or rod and two good-quality vacuum cups. Bend the rod as shown. Attach a vacuum cup to each end of the rod. The distance between them depends upon the car but usually about 18" is sufficient. To attach fasten the vacuum cups on the lower edges of the hood covers with the rod under the covers as shown in the illustration above.—E. B.

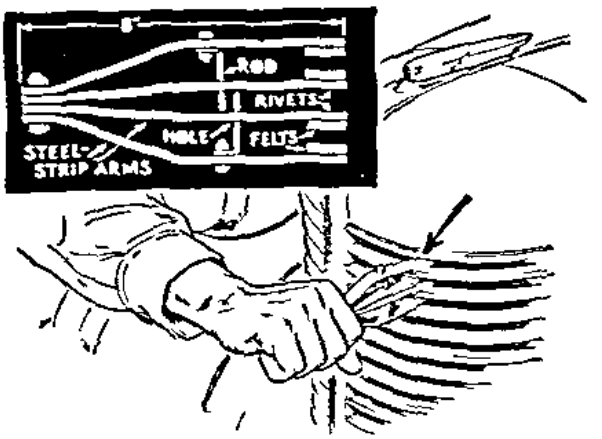
Tire Dust Caps from Erasers

RUBBER erasers of the type made to slip over the end of a pencil make handy dust caps for tire valve stems and save time when you stop for air.—W. J. L.

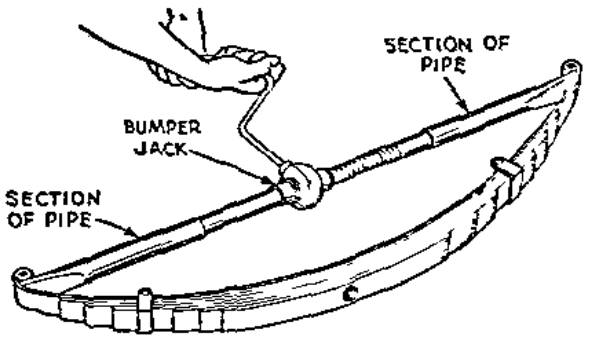


For CAR OWNERS

Tool Cleans Car's Grille Two Strips at a Time



THE little time it takes to make the device illustrated at the right will be well repaid by the speed with which it polishes close spaced radiator grille strips Soft countersunk rivets will hold the felt pads permanently in place but good rubber cement may be substituted Spacing of the jaws is determined by your grille strips Squeezing the device causes each pair of pads to close on a separate strip —F G

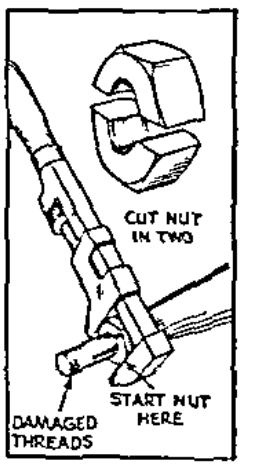


Jack Spreads Springs

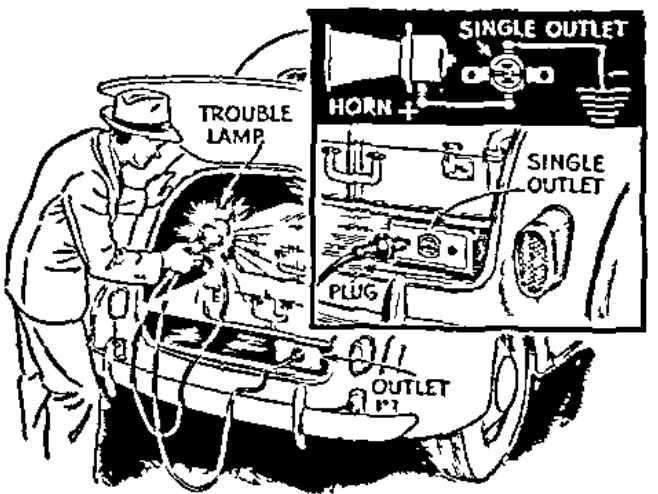
SPREADING a car spring so that the shackle bolts will slip into place can be done easily with a bumper jack and two pieces of pipe Hammer one end of each pipe flat and place the pieces over the ends of the jack as shown The outfit easily spreads a spring to the desired point.—J H

Easily Made Die Clears Damaged Axle Thread

WHEN removing rear wheels the axle threads sometimes become damaged An easily made die to clear them may be made by cutting in half a spare nut of the same thread as shown at the right and clamping the halves over the undamaged thread with a monkey wrench The halves are then screwed off over the damaged thread thereby clearing them —S A T



Trouble-Lamp Outlet for Luggage Trunk



OF REAL service during nighttime repairs particularly on the road is a trouble light outlet such as the one shown mounted in some convenient spot in the luggage compartment. Connected by rubber insulated wire to the hot terminal of the horn or ammeter and to ground the outlet is a conventional wall type unit such as is used in homes In place of a house current bulb in the trouble lamp one of six volts is substituted The lamp cord should be long enough to reach any point on the car, so that you will not be caught short in any emergency —A M

Gus Beats the Heat

THE afternoon was sunny and hot and for once there weren t any jobs standing in the shop waiting to be worked on So Gus Wilson sitting in the shade of the little porch outside the office was taking it easy and watching the cars go by

The suburban town Model Garage which Gus and his partner Joe Clark have built into a satisfactorily prosperous business stands on a main road at the foot of a slope Gus had just filled and lighted his second after lunch pipe when he heard an engine sputter and quit and saw a well shined up sedan stop at the beginning of the upgrade

A fat man wriggled out from under the steering wheel and an equally fat and very flustered looking woman moved over into the drivers seat The man walked wearily around to the rear end of the car took the cap off the gas tank climbed up on the bumper shouted something to the woman and then blew gustily into the tank The car began to move again slowly and with a succession of back fires which sounded like a burst from a machine gun The man on the bumper continued to blow into the tank

Suddenly the woman who was driving made a U turn As soon as its nose was pointed downhill the sedans engine took hold and ran smoothly The car turned in at the driveway and stopped at the gas pump The man got heavily down from his perch on the bumper and demanded to know what was the big idea

I ve had enough of this the stout woman told him dangerously I m telling you George—*get it fixed*

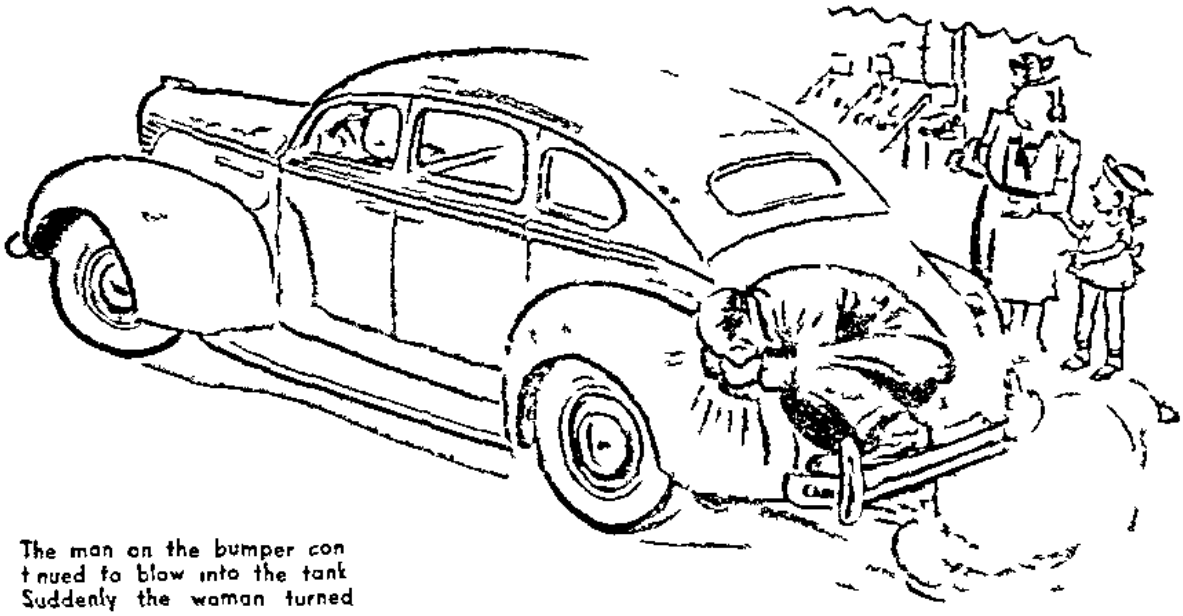
The man puffed out his cheeks—they were purple from his blowing—and glared at her I suppose you think *I* like it he said bitterly Then he turned to Gus Names George Hawkins—this is Mrs Hawkins Live up in Rhode Island We ve had this car for four years and until day before yesterday we never had any trouble to amount to anything with it Then it went bad on Mrs Hawkins—ran all right on the level but acted like the gas line was *clogged* every time she tried to go up a hill We were starting on our vacation trip yesterday morning so that night I took the bus to a garage and had it gone over They checked the carburetor and fuel pump and blew out the gas line and told me I wouldn t have anything to worry about Ain t that right Estelle?

Estelle snorted Gus couldn t make out whether she was registering agreement or disgust Her husband swallowed nervously and went on with his tale of woe

We started out yesterday morning and for fifty miles or so things went all right. The car didn't have as much pep as usual but we didn t



He ry shifted the lever nto reverse and aga n let out the clutch D ag nos s Sho t c rcu t" Gus sa d Where? And why? Dr Foley demanded



The man on the bumper con tnued to blow into the tank Suddenly the woman turned

Use Your Head Instead of Your Hands And You'll Keep Cool In Any Kind of Weather

• • •

By MARTIN BUNN

have any real trouble Then we got into the Connecticut hills and—oh boy Every time we tried to go up a grade the car *acted like it had a bad case of vapor lock* If the hill was at all steep the motor would quit dead After a while I got the idea that if I blew into the gas tank it would force a little gas into the carburetor That worked well enough to keep the bus going but before long I was darned sorry I d ever thought of it' Every time we hit a hill I d have to climb out on the back bumper and blow my lungs out'

We called it a day early in the after noon and I took the car to a small town garage Sure the feller there said it was vapor lock and he knew how to fix it He put in a new gas line from the fuel pump to the carburetor keeping it well away from the manifold He charged me plenty for the job but he told me I wouldn t have any more trouble He s a liar' It s been just as bad all day today and I m sick and tired of sitting out there on the bumper blowing my heart out and listening to a lot of smart guys make wisecracks

And I m sick and tired of this whole fool trip and of everything about it his wife put in grimly *Fix this car* up so we can get home Mister and I swear I ll never set foot in it again

I don t blame either of you for being disgusted Gus told them managing to keep his face straight 'There s nothing that ll spoil a vacation trip quicker than a balky car But if you'll drive into the shop I think I can fix up your trouble for you

As Mrs Hawkins drove into the shop her husband followed Gus Make it good, Mister he begged Estelle s plenty sore and if you fall down she ll sure give me hell

You ll be a lot more comfortable waiting in the office Mrs Hawkins Gus told the peevish lady as he held the door open for her When she had vanished in sultry silence he got into the car and stepped on the starter The engine took off but its sound told Gus that it wasn t getting enough gas

Leaving it running at moderate speed Gus got out raised the hood and examined the fuel pump and carburetor The fuel pump is pumping scarcely any gas he re marked The main gas line has been checked twice so it s pretty certain to be O K. He leaned over and eyed the rubber hose connecting the gas line and the pump then took it off This might be the joker he said Attaching an air line to the hose and holding a swarthy thumb over the other end he lowered it into a pan of water Dozens of little bubbles formed on the hose and came to the sur face That s your trouble maker he decided

He examined the hose closely then handed it to Hawkins There are several small holes in it he told him See what s been happening? Gas hasn t been leaking out of

the hose If it had been the mechanics who have worked on your job would have located the trouble Instead of that air has been sucked in through those holes As you drove uphill the suction was stronger than it was on the level and so much air got into the mixture that it killed your engine When you blew into the tank—that s a new one on me—it forced more gas into the fuel l ne and that kept your engine running Easy to fix just a length of new hose

F ve minutes later Hawkins went into the office and then came out with his wife She listened grimly to Gus s ex planation of the cause of the trouble and as grimly to the smooth hum of the engine Then she got heavily into the car

I hope you have a pleasant trip home Mrs Hawkins Gus ventured with a grin

For the first t me she smiled I guess as long as we ve had all th s trouble coming down here she said we might as well visit my sister in the city She looked at her husband and her face grew grim again Get in George she snapped Don t stand there wasting the rest of the day

Gus watched them drive away thanking his stars—not for the first time—that he had remained a bachelor Then just as he was heading for the cool office porch Dr Foley drove up to the shop door Hello Gus he greeted 'Busy?'

No Doc Gus said Just dog lazy

It s the weather the doctor said May be that s what s the matter with my car too I can t think of anything else It runs fine going ahead but the motor dies every time I put it in reverse Diagnose that case will you Gus?

Not until I ve examined the patient Doc Gus said grinning "It wouldn t be professional it would make it seem too easy l o k know that. Drive her in please

Dr Foley drove into the shop Jack up the rear end will you? Gus asked Harry the grease monkey Probably something has gone wrong with its appendix, or maybe its tonsils he told the doctor

But a routine check beneath the car failed to disclose anything wrong

Huh Gus grunted Well, I ll give her a road test

He was back inside a quarter hour Just as you said Doc he remarked as he got out. Runs swell going forward and goes dead every time you go into reverse Guess I ll have to do a job of trouble shooting Get the rear end jacked up again Harry

Harry jacked up the rear wheels. Gus raised the hood and relighted his pipe Get in he told Harry and step on the starter The engine started promptly and ran sweetly Now put her in reverse he directed

Harry did as he was told and let out the clutch Gus s quick eye saw a spark at the rear of the engine just before it stopped He peered in then put his hand in and moved something Start her again he said Now put her in reverse

Harry shifted the lever into the reverse position, and again let out the clutch The engine continued to run smoothly

Diagnosis Short circuit Gus said

Short circuit? Where? And why? Dr Foley demanded

Here s the low down on your trouble Gus explained Your engine is mounted on rubber and it moves on its mountings When the car is moving forward the engine settles down on the mountings But when you go into reverse the forward end of the engine seems to be raised a little by the torque and its rear end settles back a little Now the primary wire to the distributor passes through a narrow space between the dash and the oil filler pipe When I saw a spark there when Harry reversed I knew what had happened—that the movement of the engine on its mountings had chafed through the insulation of the distributor wire just behind the filler pipe When the car was moving forward and the engine settled down on its mountings nothing happened But every time you went into reverse the changing position of the engine squeezed that bare spot on the distributor wire between the filler pipe and the dash That caused a short circuit which killed your engine Fix it up Harry.

Dr Foley drove away and Gus went back to the office porch Joe Clark looked up from a ledger Nothing in the shop?

Nothing much Gus told him. Just a couple of those little things that are hard to find and easy to fix.

Nothing in them Joe said gloomily

Gus laughed Sure there is he said Not much profit but they re swell jobs for a hot day—they keep the old bean working and don't make you sweat too much!

GUS SAYS:

Don t let a r out of your t res on a long trip because they ve gained pressure from heat They won t ga n enough pressure to do any harm And lett ng a r out w ll only make them get hotter when you resume your journey because they ll flex more

THE HOME WORKSHOP

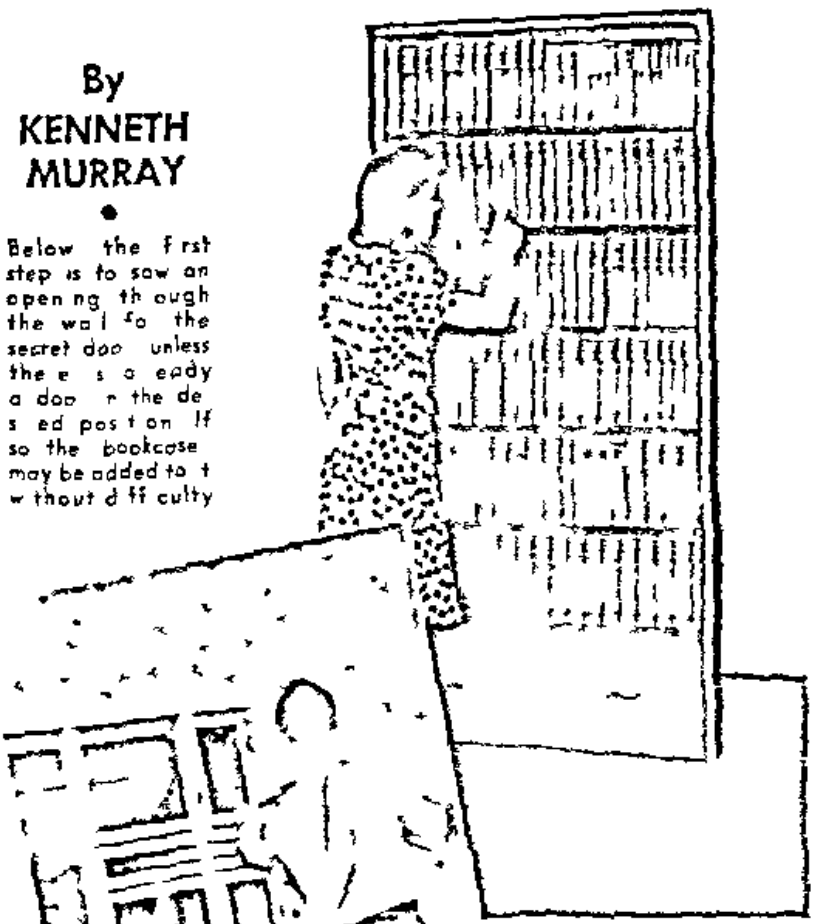


In This Issue... GAME-BIRD PLAQUES • PHOTO HINTS
SHOP AND ELECTRICAL SHORT CUTS • RADIO

By
KENNETH
MURRAY

•

Below the first step is to saw an opening through the wall for the secret door unless there is already a door in the desired position If so the bookcase may be added to it without difficulty





So attractive is this bookcase it would tempt almost anyone to step up and examine the titles yet it isn't a case and hasn't any books Instead it's a secret door leading to another room

This Bookcase



At left fitting the wide frame which was made from white pine Below the wood strips for around the door and to imitate "shelves" were sanded to even thickness by clamping a wooden guide block to the bed of the sander

Is a Secret Door

SECRET doors suggesting mystery and intrigue are interesting to every one It is not necessary to have a valid reason for building a secret door al though two can readily be found One is that they can be made more ornamental than a plain door the other is that they provide a legitimate means of surprising and amusing friends and visitors

This secret door which was built into a wall of the writer s office appears to be a well stocked bookcase but when a button is pressed it opens silently into an adjoin ing workshop and studio The effect has proved particularly gratifying when the door is opened at the moment a visitor is reading the titles of the books

An opening about 35 wide and 74 high was made in the wall and 12 wide pine boards were cut to make a frame Most of the extra width of the frame was allowed to project from the wall to form the book case

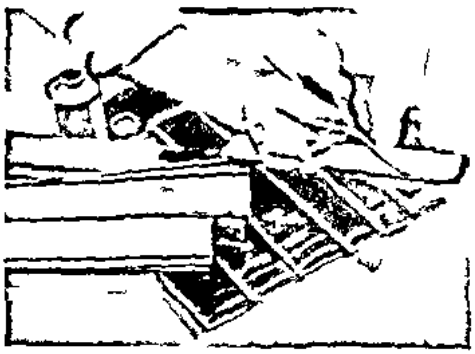
A piece of ½" plywood (¾" would be still better) was cut to fit loosely inside the frame Wood strips about ⅜" square were glued to the face of the plywood door around the edge to form a rim Other strips of the same thickness but ¾" wide were glued across the door to look like the edges of the shelves

As it is difficult to obtain enough old books that may be mutilated for this purpose it is best to purchase imitation book backs from either a furniture dealer or a book seller They are commonly supplied to deal ers by bookcase manufacturers in order to dress up their products when on display

If the backs are in strips they may be glued directly between the shelving strips on the door otherwise they should first be glued individually to strips of plywood of the proper width and thickness A space should be left at the bottom of the door for an imitation drawer front of plywood

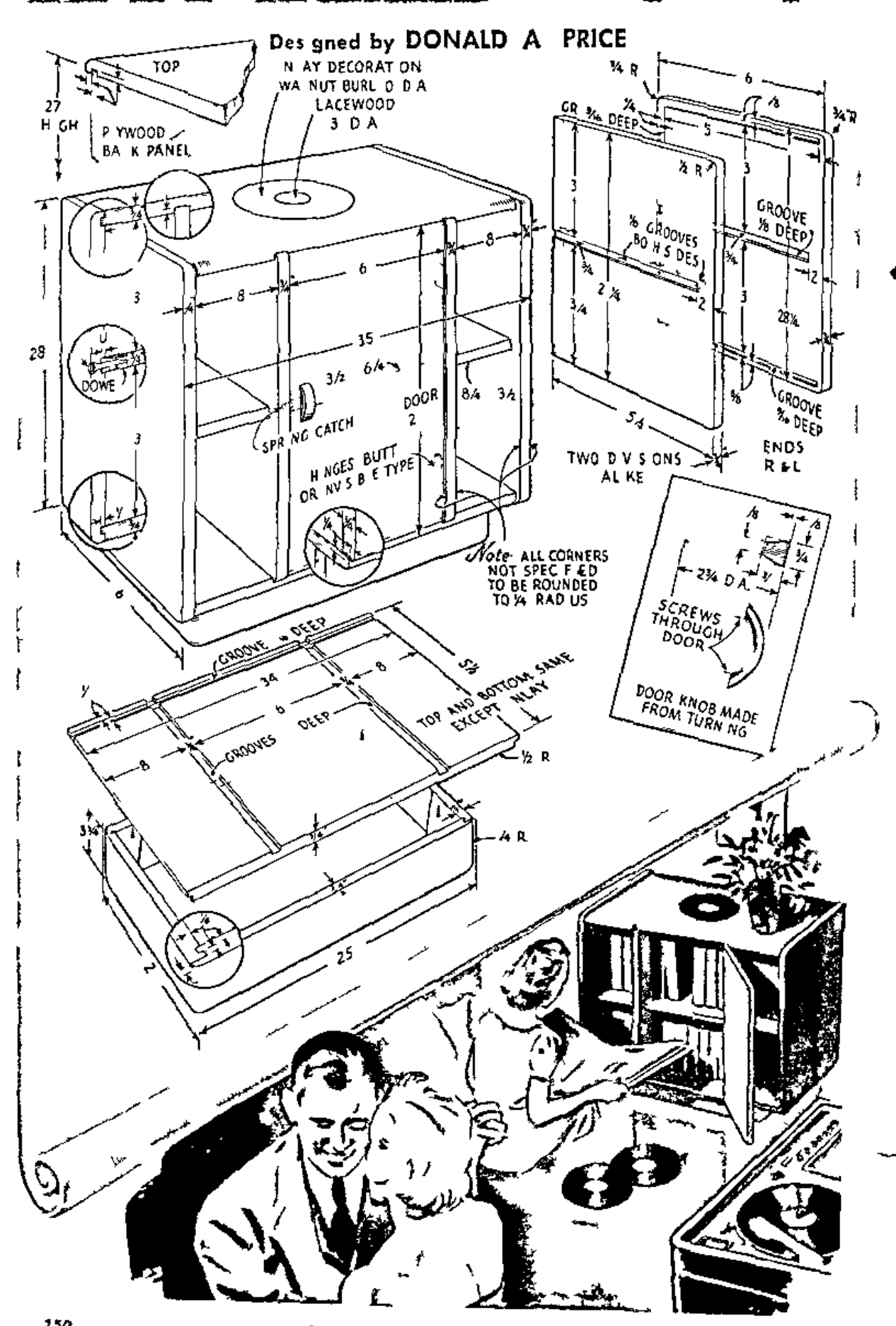
When the door has been completed and hung with butt hinges any suitable molding may be nailed around the front edge of the frame to conceal the junction of the door and the frame The exposed wood parts may be stained and varnished or enameled

Fit a spring at the back to open the door and in the frame install an electric door opener which may be purchased from any well stocked electrical dealer





Top view gluing book backs to plywood strips The backs are then attached to the door and an imitation drawer front is added as shown at the left Note how the door is hinged to the frame

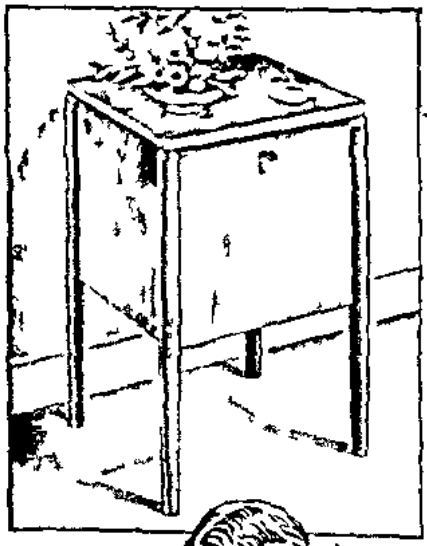

Des gned by DONALD A PRICE
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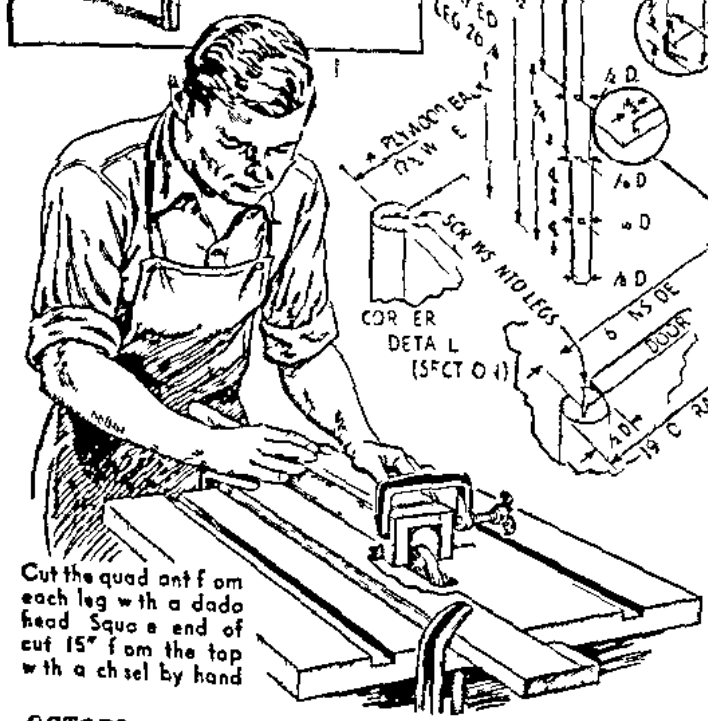
TWO MODERN Cabinets TO HOLD YOUR Phonograph Records

SO GREAT is the popularity of re corded music that it has become a problem in many homes to find a suitable place to keep the rapid ly growing accumulation of phonograph records The best solution is to provide a cabinet especially designed to hold standard record albums

Two designs are suggested in the ac companying illustrations The first is a distinctly modern cabinet for a music loving family that expects to build up a large collection of records It has a capacity of about 380 records in albums The compartments may be subdivided if desired with spacers 4 or 6" apart to keep the records or albums upright as shown in a detail The smaller cabi net has room for about 96 records

Fither design can be made in any good cabinet wood The r modern style however makes a light finish especially appropriate in which case maple blond





walnut or birch may be used as desired

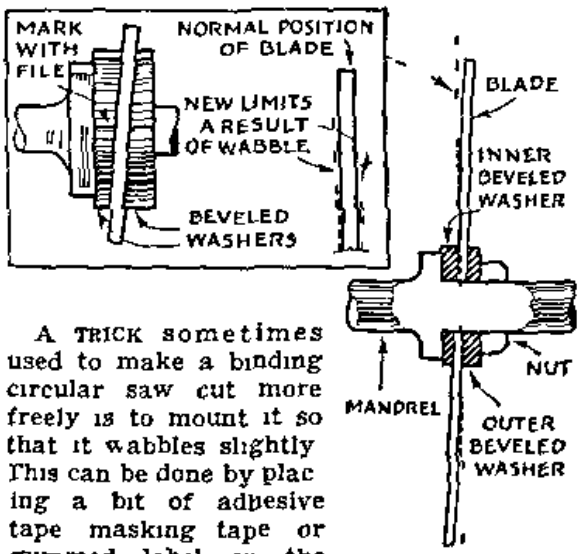
The design of the larger cabinet minimizes the trouble to be expected from shrinkage as the grain of the principal parts runs in one direction Because of this the use of solid wood is permissible although the wide boards should be glued up from three or four narrow strips to counteract warping This piece is well adapted for veneering and inlaying and the top can be inlaid if desired with a 10" disk of walnut burl and a 3" diameter lacewood center representing a phonograph record

The door can be hung with ordinary butt hinges or hinges of the invisible type It is held shut with a spring bullet catch.

In building the smaller cabinet the box should be constructed as a unit and the legs then glued and screwed in place The top is secured by screws which pass up through the strips at front and back and by two metal angles on each side If the back is to be exposed glue and brad on strips ⅛" by ¾" at top and bottom of rear panel

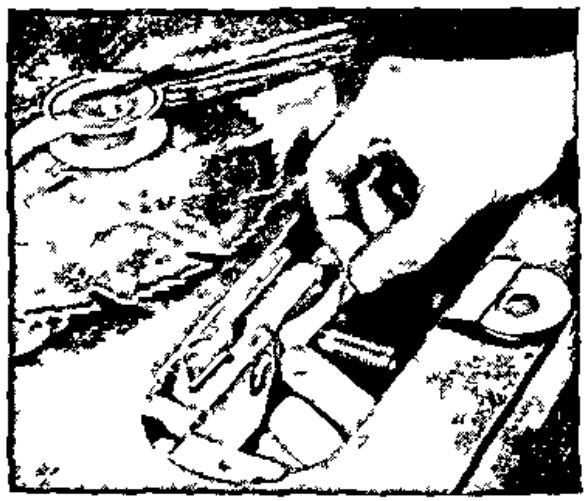
Various modifications can be made of these designs such as omitting the doors

Wabbly Circular Saw Cuts Without Binding



A TRICK sometimes used to make a binding circular saw cut more freely is to mount it so that it wabbles slightly This can be done by placing a bit of adhesive tape masking tape or gummed label on the shoulder of the mandrel as shown Then on the washer that goes against the outside of the saw a similar piece is stuck. The washer is adjusted so that its high spot is diametrically opposite that on the mandrel. As a result the saw wabbles slightly when running thus cutting a wider slot

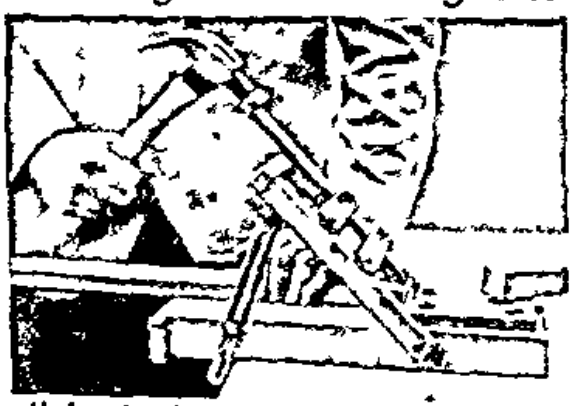
This treatment is particularly helpful with hollow ground or planer type saws



that are cutting poorly but it is only for emergency use and for fairly light cutting

A better way is to machine a pair of washers or spacers each having one surface at a very slight angle with the other These are marked so that their beveled surfaces can be placed in the same plane Pressure on the saw is then uniform and there is less danger that uneven stresses will be set up Saws having such a wabbling feature built into them are on the market

Jig for Trimming Ends of Furniture Squares



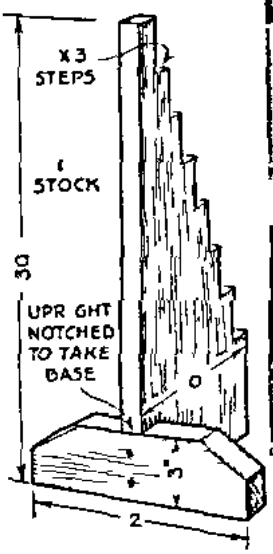
Uniform bevels can be cut at any desired angle

CONSTRUCTED from scraps the device shown is used for beveling or chamfering the ends of pieces of softwood for handmade furniture The base is a piece of 2" by 4" about 15" long The adjustable frame is of ¾" oak with two steel straps across the top to hold the chisel Slotted box lid supports provide for adjustment to different angles A piece of hardwood with slotted screw holes serves as an adjustable stop for the work

Tool steel 9" by 1" by ¼" was used in making the chisel The cutting end was ground to a 22 deg angle then hardened tempered and sharpened to a keen edge on an oilstone —J C MONTGOMERY

Support for Long Boards Being Planed by Hand

AMONG the various supports used for holding the end of long boards while being planed at the bench one of the simplest and most convenient is that illustrated A series of steps are cut out of the upright piece to permit wide work to be held level at different heights The dimensions given can be altered to suit individual needs

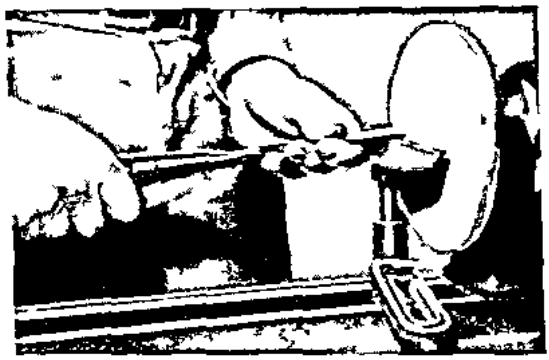


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WHEN using a step ladder for repair work tools and materials may be placed on the top step if strips of ¾ by 1" wood are nailed or screwed around the edge to form a tray The strips will not prevent stepping on the top step when necessary



Steps cut in the upright piece allow wide work to be held level at different heights



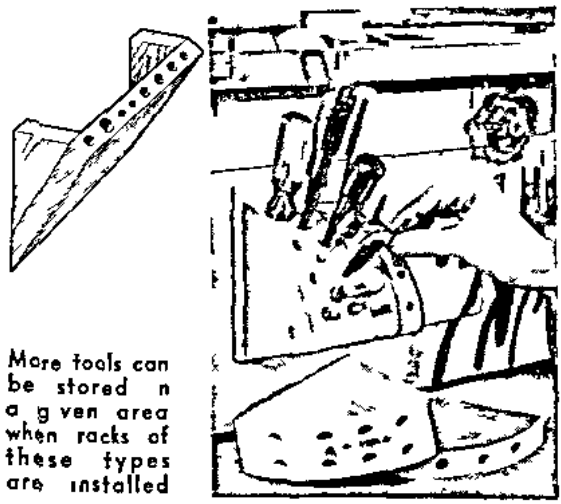
Handy Racks for Punches and Other Small Tools

ONE of the commonest racks for tools such as punches and screw drivers consists of a strip of wood with holes bored at intervals along one edge Instead of mounting such racks flat tilt their upper edges outward so the tools can be inserted and extracted at a convenient angle or bore holes in a series of segments cut from circular disks and mounted side by side Each segment should cover about 60 deg of arc with holes spaced every 10 or 15 deg

Cork Facing Improves Metal Sanding Disk

IF A SANDING disk is faced with cork the garnet or aluminum oxide paper will last considerably longer A roll of 1/16" or ⅛ thick cork may be obtained from a mail order house or craft supply shop Brush casein glue on both the cork and the metal disk apply pressure and leave to dry overnight If the sanding disk happens to be a little out of true use ⅛" cork so that it can be turned true after being glued

Rubber cement is used to fasten the abrasive paper to the cork Apply a coat to both surfaces let dry five minutes or more, apply a second coat to the cork surface and again let it dry Then press the disk against the cork surface —ERIC L. BUSS

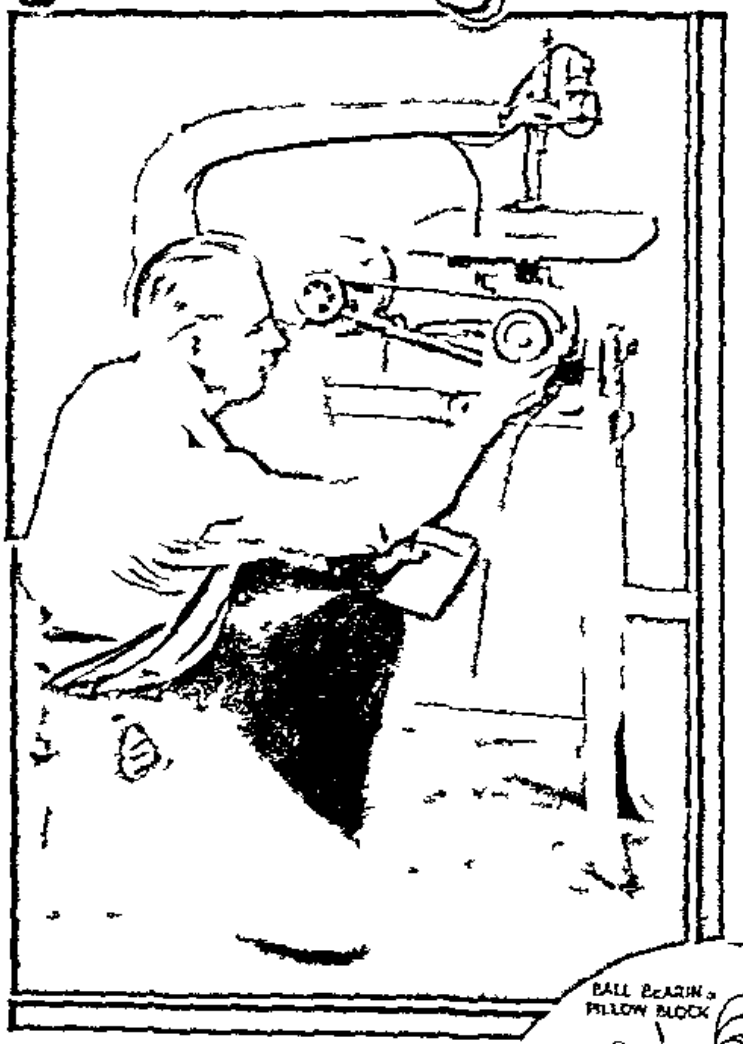


More tools can be stored in a given area when racks of these types are installed

Economical

HOW TO MAKE ONE MOTOR

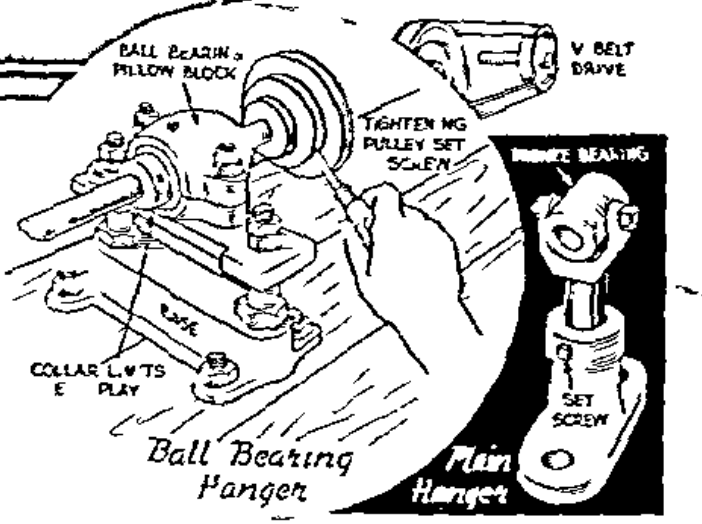
By EDWIN M. LOVE



A MACHINE is an individualist usually giving its best when driven by its own motor. A flip of the switch and the lathe whirls or the drill bites into the work.

With the possible exception of a circular saw and jointer combined in one drive, the maximum output and convenience are achieved in the home workshop by allotting a motor to each machine. All available power in the motor is delivered to the pulley with none wasted in belts and bearings along the line shaft. There are no belts to be removed or replaced, and no heavy motor to be dragged from one power tool to another.

In actual practice however many home workers have to make one motor serve for several machines. It is sometimes argued, in fact, that a line shaft is an advantage because one powerful motor can be used instead of several small ones, thus saving on the purchase price and speeding up



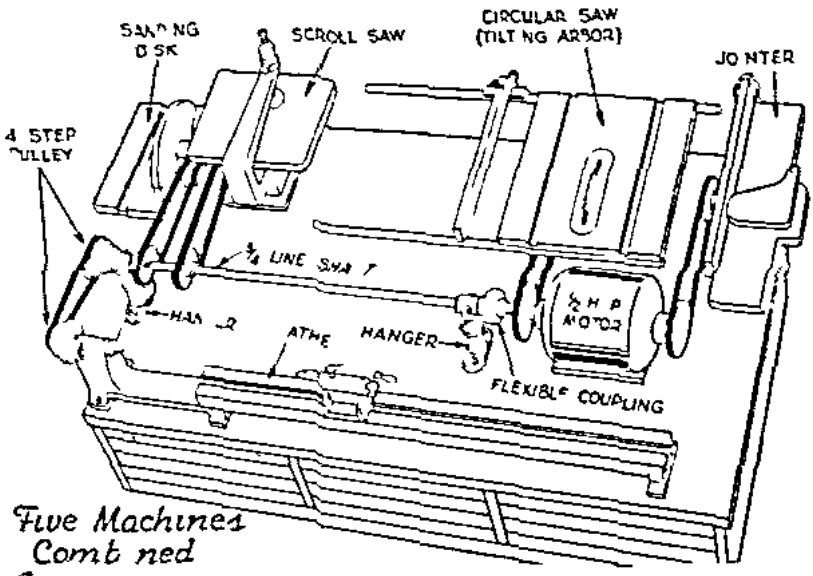
ROBERT JAACKS, WHO IS EQUIPPING his home workshop on a monthly budget of $15, checks the speed of his scroll saw by making the pulleys to count the turns of each. He now has a good assortment of hand tools and a small bench and wall cabinet. His shop is equipped with an 8" circular saw, a 4" jointer and a 24" scroll saw. Among the accessories are a saw table, *extension basket guard* and dado head. He will celebrate the first birthday of his shop by the purchase of an 11" wood turning lathe with a good set of turning chisels and a sanding disk.

Workshop Layouts

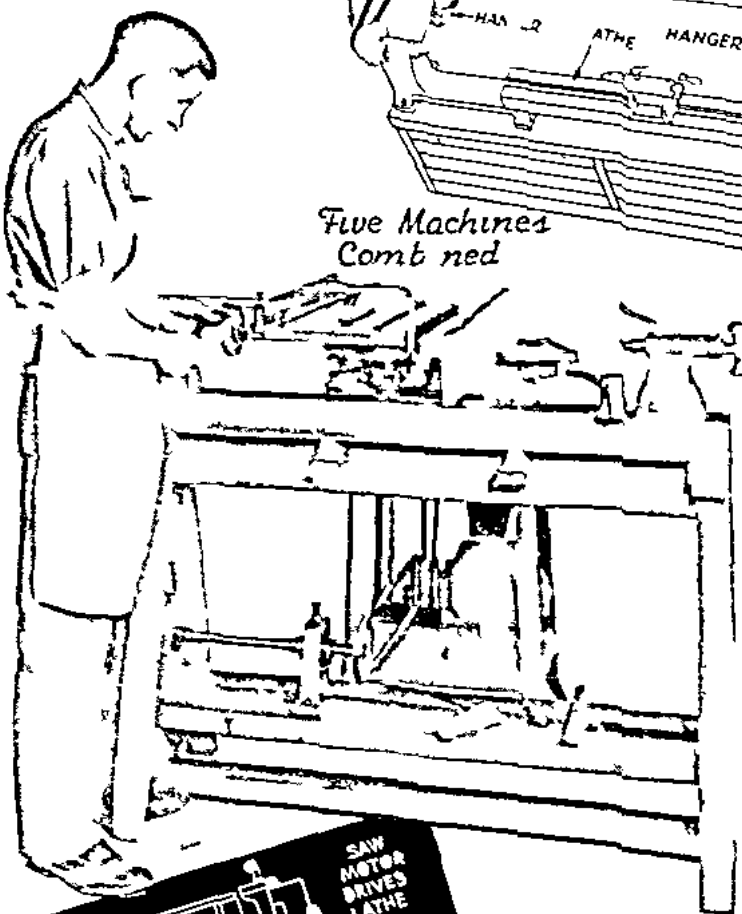
DO THE WORK OF TWO OR MORE

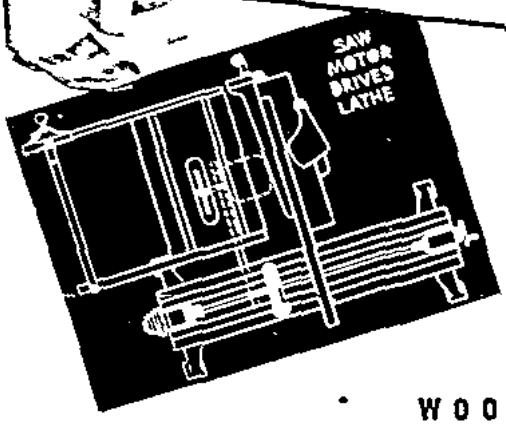
At the right is a space saving layout of five machines of standard size on a bench top 44 by 56

Driving a lathe from the motor of a combination saw and jointer. Note the board on the jointer which was placed there to show that it clears the lathe bed without any difficulty



Five Machines Combined





heavy work on the circular saw. Unfortunately half horsepower motors are the largest permitted on lighting circuits. This size is none too big for the circular saw and if it is required to drive shafting as well the saw is the loser. Besides the shaft requires power when idling and runs up the bill for electricity. These in brief are the pros and cons of individual and combination drives.

What are countershafts and line shafts?

Countershafts or jackshafts are short units provided with pulleys that serve to reduce or increase speed of rotation or to provide for a number of speeds in one machine. A line shaft is longer and designed to operate several machines. A line shaft is necessary for gasoline drives as it would be impractical to have an engine for each machine.

If a power tool has a countershaft, couldn't other machines be driven from it?

This is quite possible and one good way

to economize with motors Most wood turn ing lathes can be fitted with countershafts in fact they must be if metal turning is to be done

The drive for the lathe will also operate a scroll saw or a band saw or both The scroll saw can be placed at the head of the lathe w th a belt d rect from the shaft or a shorter belt from the headstock may be used If very large faceplate turning is often done at the left end of the lathe head stock t would be wise to have a belt long enough to permit the saw to stand entirely clear of the lathe A band saw would be placed farther back or behind the lathe to obta n suffic ent space

The machines could be assembled on a bench wide enough to take all or on one bu lt in T or L shape It is easy to mount the lathe low enough so that it will not obstruct long or wide lumber being worked on the saws An example of how a lathe can be placed in such an arrangement is shown on the preced ng page

The higher powered circular saw motor can drive a lathe as well as a jointer Stand the lathe at the back of the saw belting its countershaft to the motor For cutting very wide stock on the saw the headstock of the lathe must be removed which is easy if a special wrench to use from below or from the end is made The lathe could also be pulled endwise to clear wide stock

How may more machines be arranged for driving from one motor?

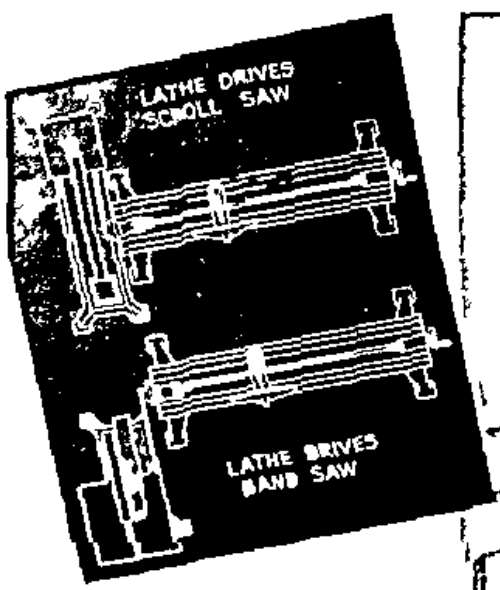
Halford R. Thomas of Alhambra Calif has an ingenious set up of six machines mounted on an old washing machine base Casters allow the group to be pushed around as desired so that long boards being cut on the saws can be steered through the door

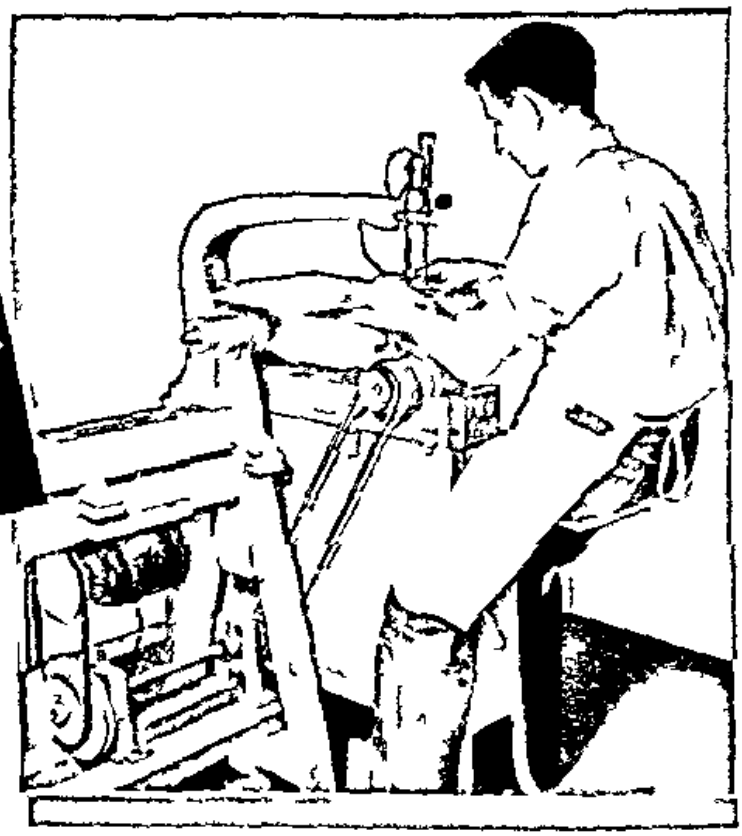
Another good arrangement which com bines five standard size machines is shown in a drawing on a preced ng page These are all mounted on a bench top about 44" by 56" The motor is connected directly to the l ne shaft but a little change would allow the use of a longer shaft belted to the motor giving additional speed at a little more cost and permitting the saw and jointer to be used without need of driving the shaft

Is shafting d fficult to install?

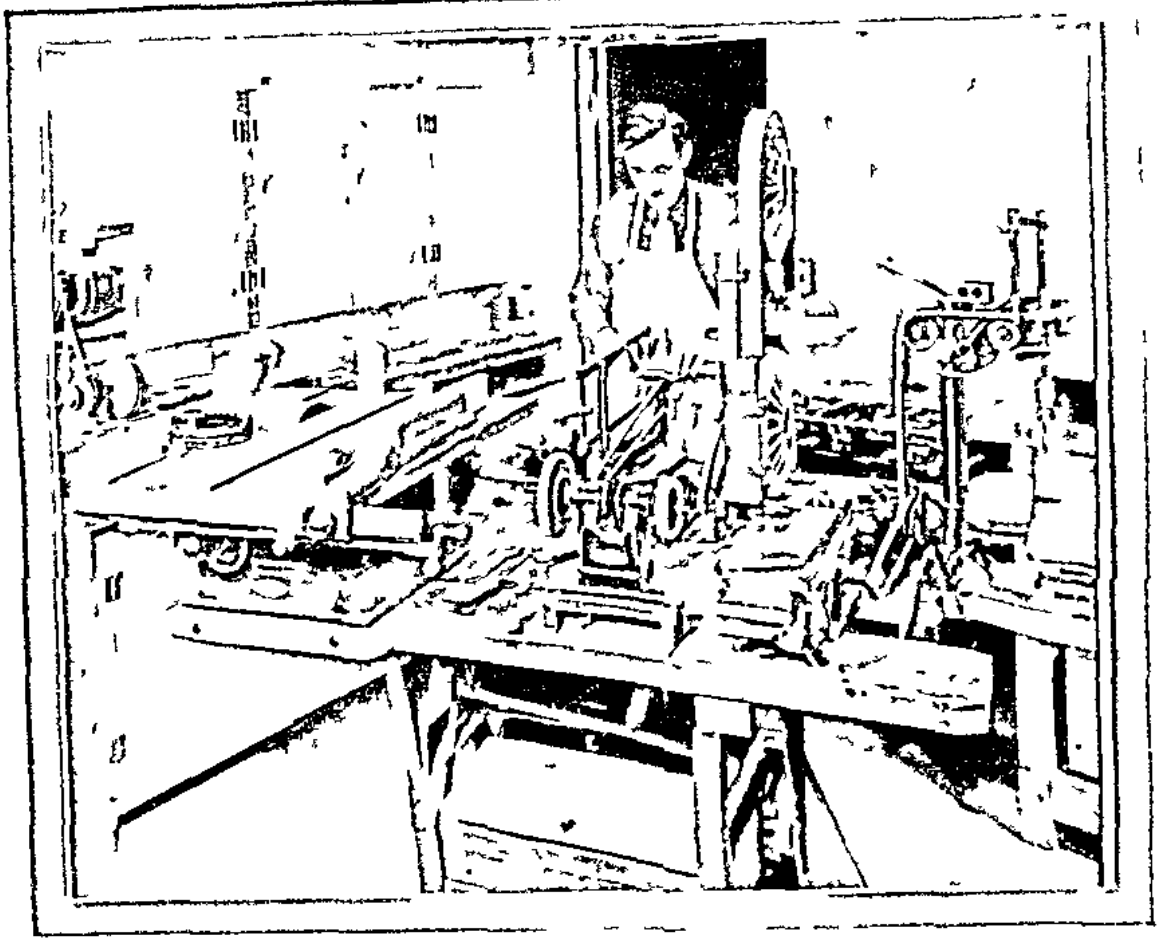
No the installation is fairly easy A length of shaft will act as a straightedge Slip on the needed hangers prop the shaft in position and screw the hangers in place bringing the bases to a line Tighten the set screws for the height adjustment of the end bearings and try the shaft with the fingers Binding indicates twisted bearings The intermediate hangers are then adjusted If the columns are not adjustable for height the bases may need shimming

If more than one shaft length is required

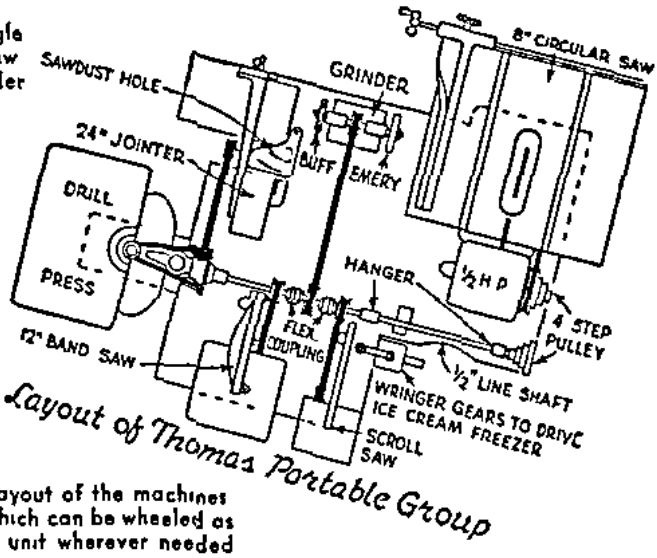




Mr Love demonstrates the use of the lathe countershaft to d ve a scroll saw W th a longer belt the saw could be set back far enough f om the lathe to allow the outboard turn ng of ve y large faceplate wo k



In Holford R Thomas' shop a single motor drives circular saw scroll saw band saw drill press jointer, grinder



Layout of Thomas Portable Group

Layout of the machines which can be wheeled as a unit wherever needed

use a coupling preferably a flexible one which will take care of slight misalignments Use clamp-on collars to limit end play

What do shafting and accessories cost?

Shafting ground true can be bought for as little as about 12 cents a foot for ½ diameter in 24 lengths suitable for driving light machines. For heavy work, use ¾ , costing around 25 cents a foot Solid couplings in these sizes are 18 and 29 cents up, and flexible rubber-cushioned couplings 25 and 40 cents Bronze bushed hangers are around 90 cents and $1 15 self-aligning ball bearing hangers, ¾", about $4 70 Bronze bushings need frequent oiling, ball bearings require only occasional oiling and waste less power

V-belts are used almost exclusively in the home shop In general, they are more efficient and less wearing on the bearings than are flat belts They cost as little as a cent an inch for widths of ½ Pulleys are available in many sizes and prices, and are either die cast or pressed from sheet steel Most of them are locked on the shaft with set screws, although in larger sizes keys are often used With such a choice of pulley

s zes and belt lengths machines can be run at any chosen speed and placed wherever desired

Can countershafts be used vertically?

Yes if equipped with ball thrust bearings to carry end loads Such arrangements can be used for dr ving drill presses and shapers but they must be mounted on rigid uprights To be driven from hor zontal shafts they must be equ pped with miter gears or with a belt bent over a pair of pulleys to bring the belt hori zontal The expense and trouble involved usu ally offset any saving effected by not buying a motor

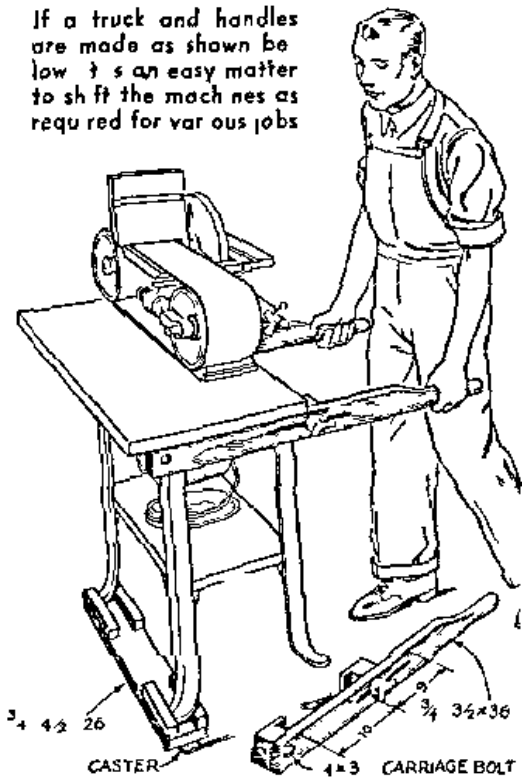
How are pulley sizes figured?

Roughly rotation is proportional to diameter A 2 pulley turns about twice as fast as a 4 pulley belted to it For more accurate figures subtract the thickness of the V belt from the pulley diameters since the belt bends near the center of the th ckness There is a little varia t on due to belt tens on speed and load

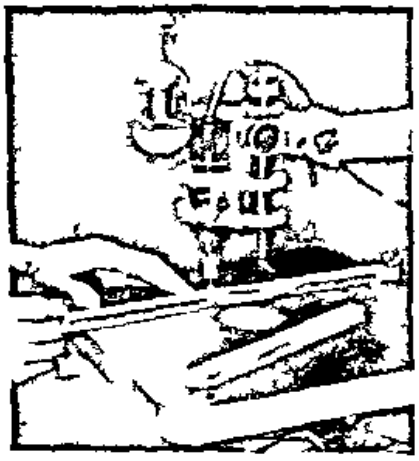
V belts need not be drawn tight as they grip w th a wedg ng act on that increases according to load

(TO BE CONTINUED)

If a truck and handles are made as shown be low t s an easy matter to sh ft the mach nes as requ red for var ous jobs

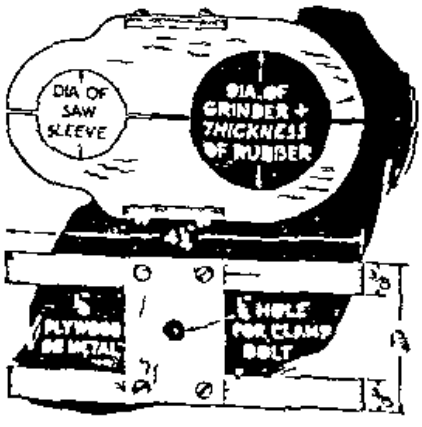


Hand Grinder Used on Scroll Saw for Shaping



BY CLAMPING it to the saw sleeve of your scroll saw a small high speed hand grinder can be mounted for delicate shaping routing sanding and the like The size of the plywood bracket for attaching the grinder will vary but approximate dimensions are given The two main clamps are cut from $\frac{3}{8}$" five ply wood al lowance being made for the thin rubber that is glued to the gripping surfaces Two metal or plywood connec tors are drilled for a $\frac{1}{4}$" bolt and are screwed to the clamp plates A wing nut locks the unit in place

A two piece wooden guide fence is clamped to the saw table If a small section of the fence is cut away it will allow for the cutter when lowered Vertical ad justments can be made either with the tension adjust ment screw or by moving the bracket itself A slight pressure will hold the grinder rigidly—H HANSCOM





The motor tool clamp on the scroll saw sleeve For st a ght shap ng o rout ng a wooden fence is attached to the table



Unbleached muslin patches are applied with roofing paint over all spots that have been cemented

HOW TO PATCH AND PAINT

Old Tin Roofs

By RALPH G. WARING

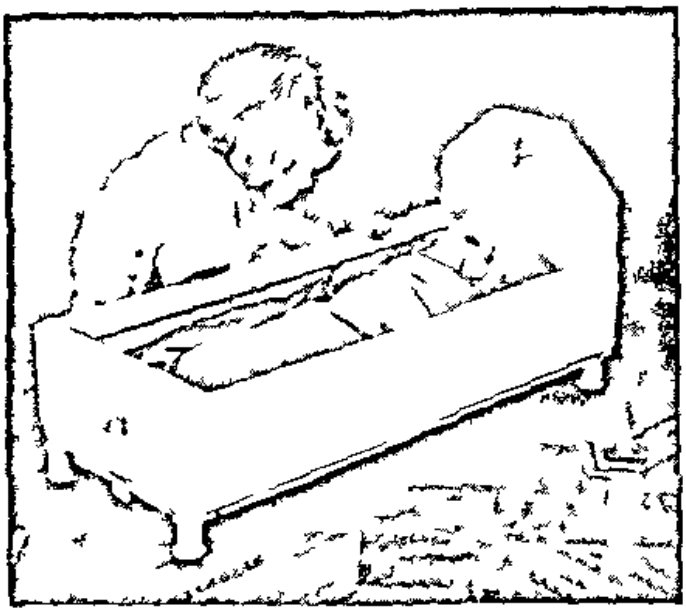
TIN roofs, which are frequently found on old houses and other buildings will last almost indefinitely if properly maintained The roof illustrated above was laid in 1868 and should be good for another quarter of a century at least

Roofs should be regularly inspected in the fall and spring When it is necessary to refinish a tin roof, all seams, especially of the flat type, should be scratch brushed and scraped clean and free of scaled, blistered, or cracked paint The rough edges should be feathered down with coarse sandpaper to the clean metal These areas should be immediately primed with a rust-inhibitive (preventing) paint and allowed to dry twenty-four hours

If a nail has worked its way up through the metal here and there, it should be driven down with a large nail set Level off the holes with marine deck crack filler or other suitable plastic cement compound Without waiting for it to dry, apply a thick coat of roofing paint over the cement, and to reenforce this, lay on an oval patch of unbleached muslin Smooth it out with the paintbrush while coating the cloth with paint Allow such patches twenty-four hours to dry before painting the entire roof

For the protection of gutters genuine asphaltum-base paints thickened with short fiber asbestos may be used Small leaks can be stopped with this heavy type asphaltum paint, but where badly damaged areas are evident, these should be coated first, then reenforced with cloth patches, and immediately recoated

Where new metal roofs are to be laid, the metal should be back primed with a modern rust inhibitive metal primer before being seamed The finished roof must be primed with the same primer before being painted The newer forms of molybdenum and copper bearing galvanized sheets are, of course, especially resistant to weather and rust, but they, too, should be given a coat of galvanized-metal primer and one or two coats of any of the newer and better synthetic-base roof coatings



Although inexpensive this toy will delight any small girl

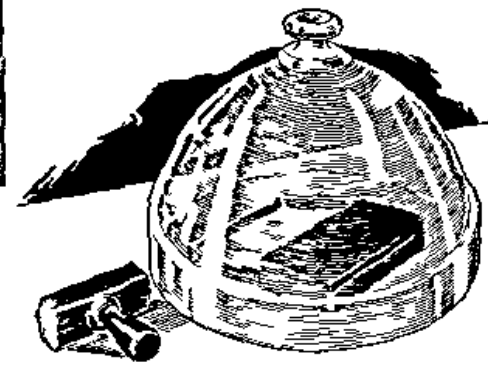
Child's Doll Bed Easily Made from Empty Orange Crate

AN ORANGE crate can be made into a doll bed by removing the middle crosspiece and also the top side piece on each side. Then saw the head and footboards to suit your fancy and glue a spool under each corner for legs. If desired reënforcing strips of wood about ½ by ¾" may be fastened to the sides of the bed at the top and also under the bottom.

Sandpaper the bed thoroughly, apply a couple of coats of enamel and add a small decal transfer to the headboard.—B. P. S.

Butter-Dish Lid Covers Opened Stamp Pad

TO AVOID having to open his stamping ink pad frequently each day, one shipping clerk uses the glass cover from a ten cent butter dish to protect the open pad from dust and keep it from drying out. The cover can be lifted off and replaced in much less time than it takes to open and close the tight fitting lid of the pad.



WANTED FARM TRACTOR HINTS FOR HOME WORKSHOP SECTION

If you have developed any especially good methods of repairing and maintaining farm tractors, send brief illustrated articles describing them to this magazine. Cash is paid upon acceptance for all available material.

SOLDERING PASTE [FORMULAS]

Petrolatum, plain	3 oz.	Zinc chloride	1 teaspoon
Sal ammoniac	1 teaspoon	Water	4 teaspoons

Heat the water, stir in the salts until dissolved, then add the petrolatum or petroleum jelly, which is sold under various trade names, and boil slightly. Let cool before use. Apply to well cleaned metals as a flux for solder. This is a noncorrosive flux for electrical work provided all spliced joints are taped afterwards.

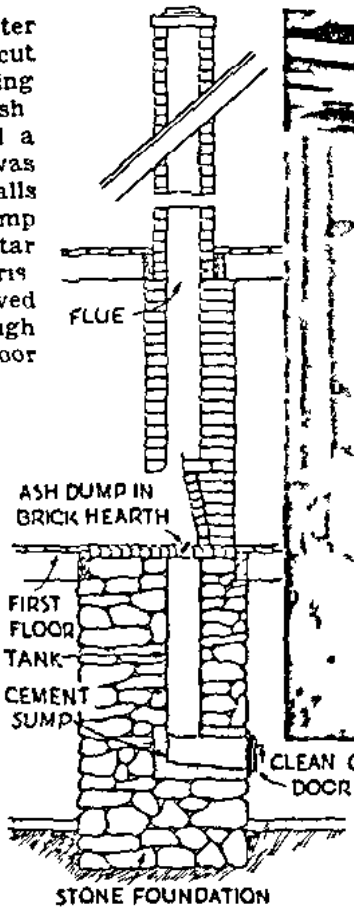
POPULAR SCIENCE MONTHLY SHOP DATA FILE

Hot-Water Tank Lines Fireplace Ash Dump

A DISCARDED hot water tank with the ends cut off was used in constructing this improved fireplace ash dump chute As illustrated a collapsible wooden form was set up for casting the walls and ceiling of the sump chamber After the mortar had set the boards comprising the form were removed by pulling them out through the clean out door The floor of the chamber was then cemented in flush with the door sill

Located directly over the chute the ash dump operates through an opening in the brickwork of the hearth Where the bricks span the open top of the chute they are supported on short lengths of angle iron

The tank provides a safe fire tight lining for the shaft and the smooth metal wall permits ashes to drop freely from the hearth to the clean out door





Placing the hot water tank Note collapsible form for casting walls of sump chamber

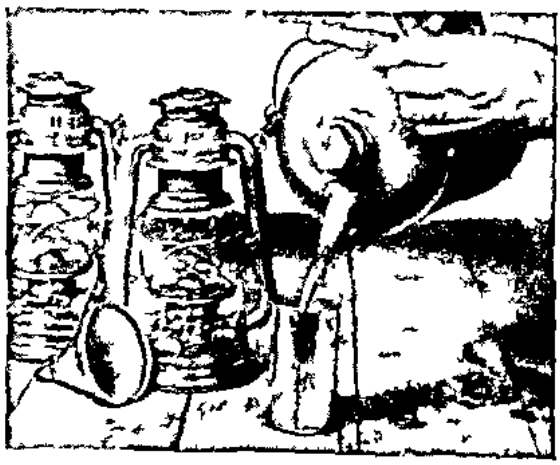
Liquid Glue Applied with Ear Syringe

LIQUID glue may be neatly applied to any surface with a small ear syringe The mouth will become sealed of its own accord but the dry glue at the tip can be instantly removed by squeezing



Measuring Cup Prevents Overfilling Lanterns

IN FILLING oil lanterns the use of a measuring cup will prevent wasting kerosene by overfilling Any can jar or bottle which holds the same amount of oil as the lantern will serve the purpose There is then no need for pausing to watch the rising oil level —J M

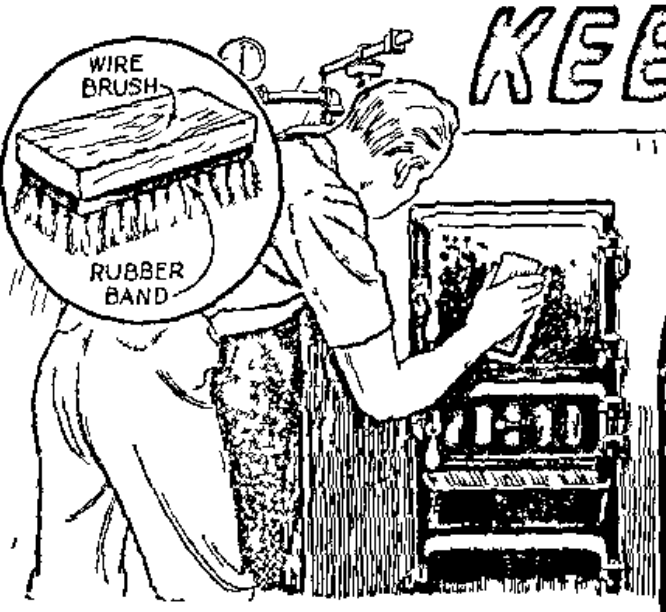


Keeping Glass from Sliding

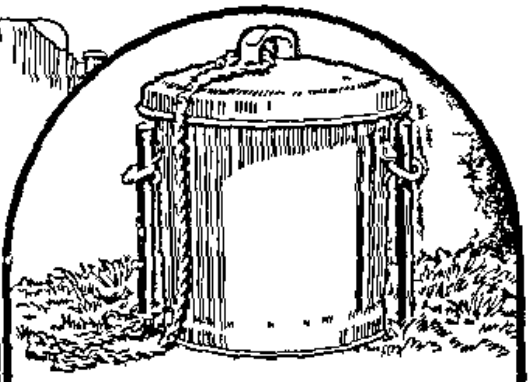


Sometimes a plate glass top slides around on a desk or table top When this happens it may be stopped by placing a piece of transparent cellulose tape folded with the sticky side out under each corner as shown in the sketch at the left

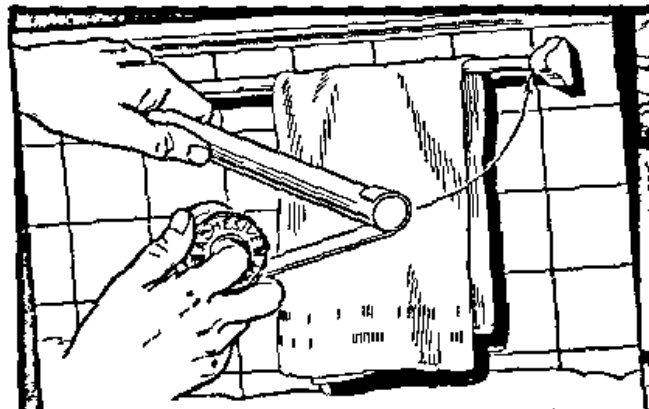
KEEPING THE



Frayed edges of a steel w re brush can be kept from in uring f ngers by stretch ng a rubber band cut out of an old nner tube around the base of the br stles



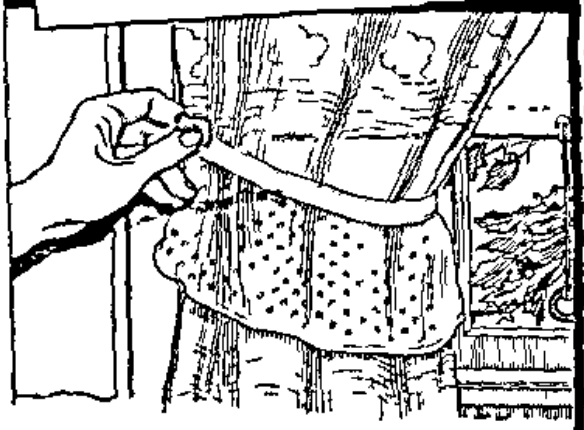
Two pieces of ½" pipe pounded into the ground to take the handles of a garbage can will keep it from be ng knocked over The cover is chained



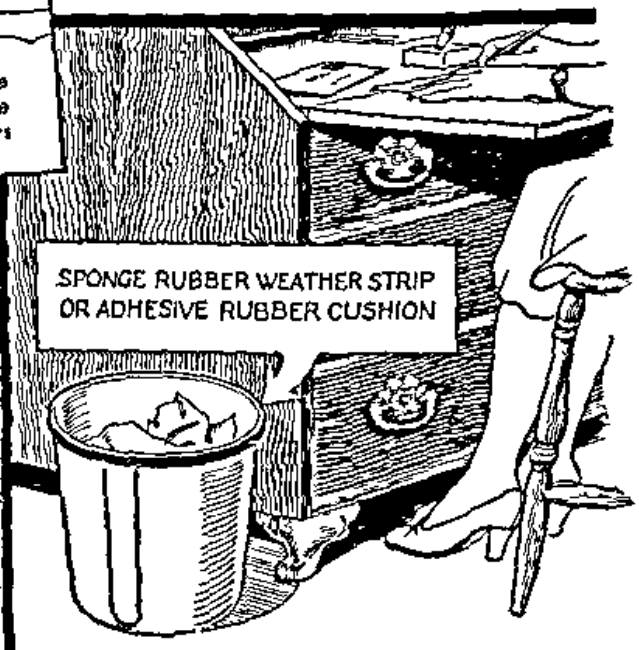
Towels will stay on racks of the loose bar type more easily if adhesive tape is appl ed to the ends to prevent rotation in the bracket sockets



By bend ng its wire ba l to form two hooks a small bucket can be hung on the clothesline and used to keep clothespins easily accessible



When hanging curtains requiring t e backs the window shade can be used as a guide to l ne up the two p ns S mply drow the shade to the proper he ght and push the t e backs in place. Th s el m nates try ng to s ght across by eye



To prevent the upper rim of a waste basket from marring your furniture such as a desk attach a strip of sponge rubber weather strip or adhesive rubber cushion to the rim This acts as a bumper

HOME SHIPSHAPE



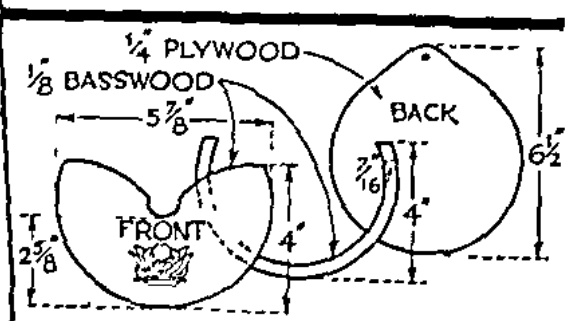
When shoe leather is scuffed lift up the loose piece apply clear cellulose cement underneath and press toward the edges with your thumb nail Scrape away excess cement



A window washer can keep his drying towel at hand by knotting one corner and inserting the knot in his hip pocket It will not fall out

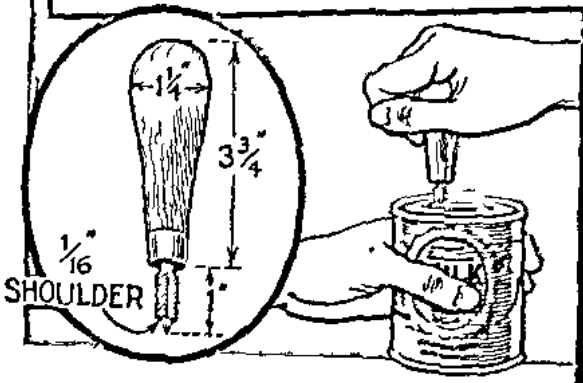


There is often room in a kitchen cabinet to install a sliding board having a hole into which a bowl will fit. Then one hand is free while the other stirs the contents





Easily rig sawed from basswood and plywood, this holder provides a convenient place for storing the rubber sink stopper when it is not being used Fasten holder above the sink in a handy location



This tool punches holes in milk and fruit juice cans Use a piece of slim taper file and grind point to a pyramid shape, making all edges keen



Quilt blocks to be cut from silk scraps can be prevented from slipping if each piece is gripped with fine sandpaper cut to form a double pattern

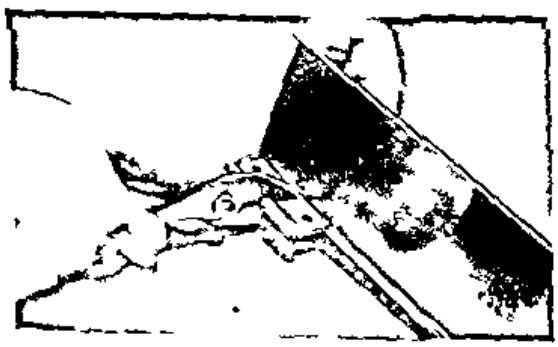
Two-Handled Wire Brush Scours Scaly Paint

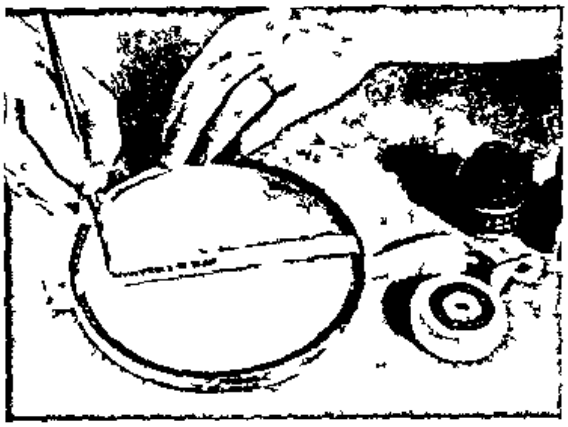
AS AN AID in using a wire brush with both hands for scouring paint from buildings, bolt the short leaf from an old auto spring onto the brush or use a suitable piece of strap iron Drive screws into the wood at each side of the handle as shown below to keep it from turning



Butt Hinge Helps Bend Sheet-Metal Edges

WITHOUT special tools it is difficult to bend up the edges of sheet metal neatly Perfect work can be done however, by using a large butt hinge and a pair of slip-joint pliers as illustrated in the photograph below The hinge makes possible the bending of sharp corners and prevents marring the piece of metal.





Disk in Hoop Backs Cloth

A WOODEN disk, turned to fit inside an embroidery hoop is useful to back stretched cloth when designs have to be transferred to it by the hot iron method or traced by hand Strips of tape also can easily be held with this device for marking, as shown above A fairly hard wood is the best kind for this purpose

Cardboard Box Converted into Temporary File



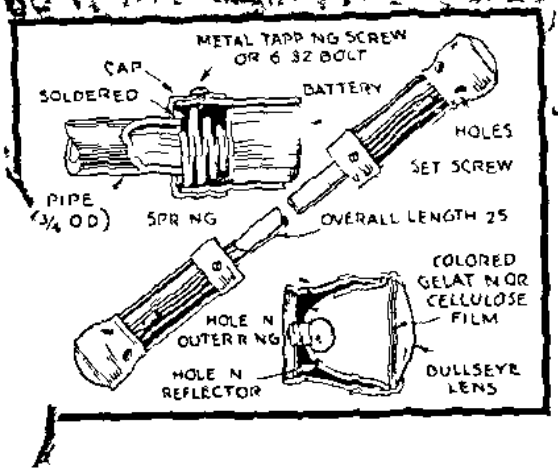
FOR temporary use, a correspondence file can be made from an ordinary two-section cardboard box Remove an end from both sections and hold them together with a couple of rubber bands as illustrated The file can easily be extended for removing and filing individual letters



Suction-Cup Door Bumper

TO ATTACH a door bumper for temporary use without marring the woodwork, improvise one as shown above A rubber suction cup is attached to a small cork by means of the screw, and the cork is forced into a rubber crutch tip The suction cup will hold the bumper on any smooth surface

ILLUMINATING Band Uniforms and Batons



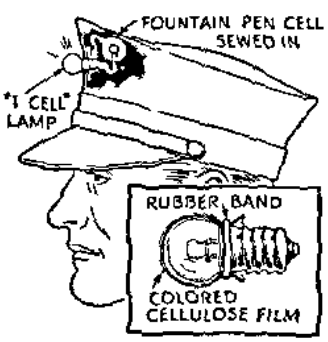
AT NIGHT performances the Willough by, Ohio High School band arouses much favorable comment by the spec- ıcular use of illuminated batons and uni- ɔrms Stadium or auditorium lights are turned out and the band uniform lamps and illuminated batons instantly turned on The ight display with the music provides an mpressive spectacle Miniature electric amps and batteries of the flash-light type nake the stunt possible, and any band can tuplicate the effect without ifficulty

The construction of an illu- minated baton similar to that sed by the band is shown On ne ends of a length of nickel or chrome plated pipe meas- uring about ¾" in outside di ameter are mounted metal- based two cell flash lights These use the 1" diameter baby" type battery cell

Several small holes are cut in the front ring and reflector of each flash light to let rays from the lamp pass out through the sides Colored gel atin or cellulose film disks are placed behind the lens which preferably, should be of the bullseye variety so that it will be visible from the side Set screws prevent the cases from unscrewing out of the caps as the baton is whirled The twirling of the baton presents a beautiful pattern in the dark

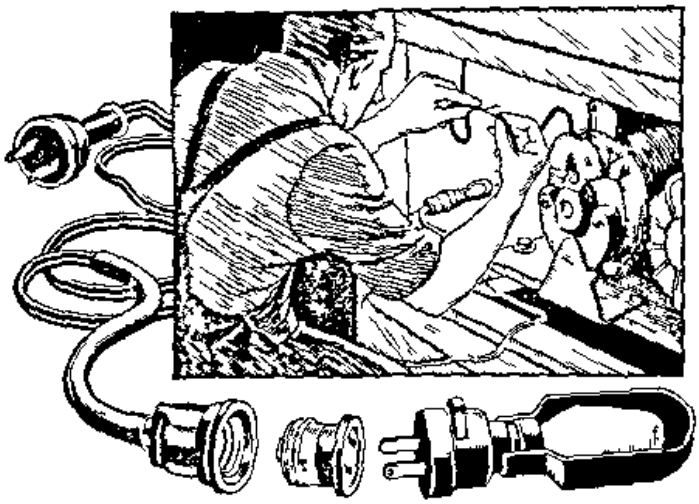
The Willoughby band also uses colored electric lamps installed on the shoulders, chest and caps of the players uniforms Flash-light lamps colored filters for them, small flexible wires, and the necessary bat- tery cells are the only equipment required

The method of illuminat ng a bandsman s cap is shown in detail The lamp is turned on or off by screwing it in or out, and it should therefore fit the socket tightly enough to prevent its loss when partly unscrewed



Method of mounting lamp in a bandsman s cap The bulb must fit the socket tightly

Uniform lights are similarly arranged, but should include a switch A flash light minus its lens is carried in a pocket. It is fitted with a plug which can be screwed into the lamp soc- ket and wires run from this plug to lamps mounted on shoulders and chest or other parts of the uniform So-called Litz wire ' is excellent because it is small and highly flexible This wire was formerly much used for installing loop radio aerials —WALTER E BURTON



Small Trouble Lamp for Confined Work

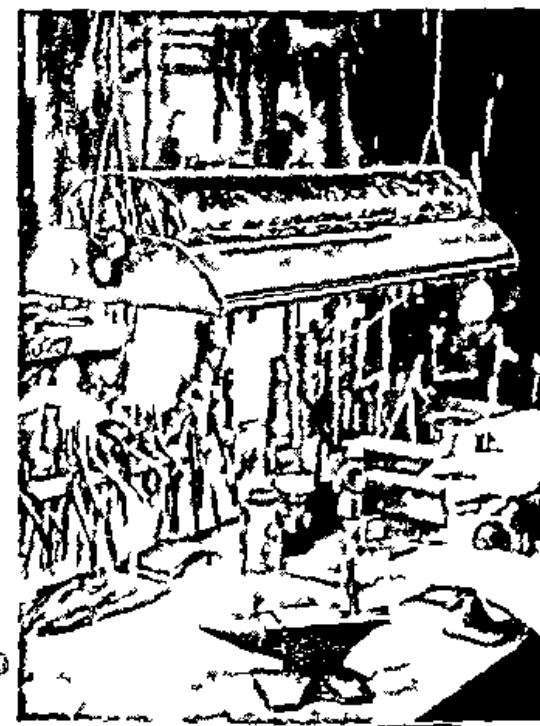
WHEN splicing wires in confined spaces the average trouble lamp gives excessive light and heat A small night light bulb with guard and switch attached is better for most work of this kind A soft rubber plug and a weatherproof socket are used The connections where the cord is spliced to the leads of the weatherproof socket and enters its plug should be protected with rubber tape and this in turn covered with rubber hose —RAY BLAIN

Eaves-Trough Fixture Holds New Tubular Lamps

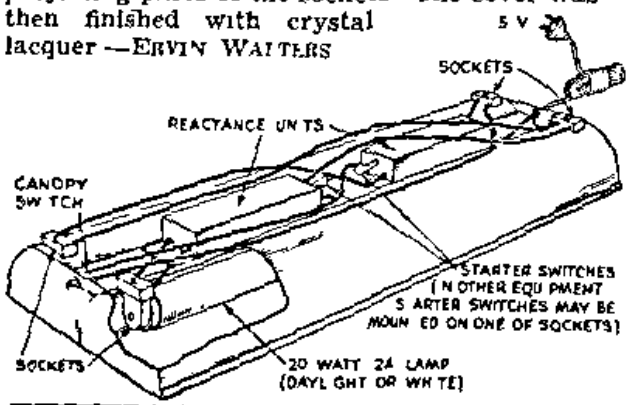
EXCELLENT reflectors for tubular fluorescent lamps can be made from ordinary galvanized iron eaves trough The photographs show a lighting unit for two 24 long 20 watt lamps Two 25 lengths of 5 trough were soldered together along the unrolled edges and end caps were soldered in place A stiffening strip 2 wide was soldered between the troughs and it also acts as a base for the reactance units

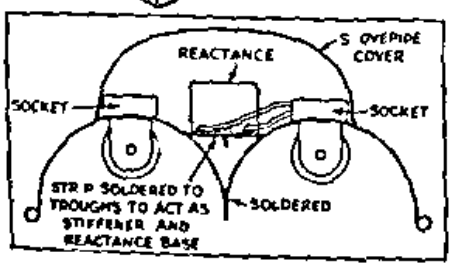
Rectangular holes were cut for the lamp sockets and the reactance units were fastened to the stiffening strip with self tapping screws The inside surface of the troughs were given a coat of aluminum paint followed by two coats of white casein paint On the outside the reflector unit was finished with lacquer

A length of 3 stovepipe was separated at the seam spread apart and provided with soldered on ends so as to form a cover for the reactances and wiring It slips down around the projecting parts of the sockets The cover was then finished with crystal lacquer —ERVIN WALTERS



At left how the fixture is made below soldering two troughs together above a completed lamp



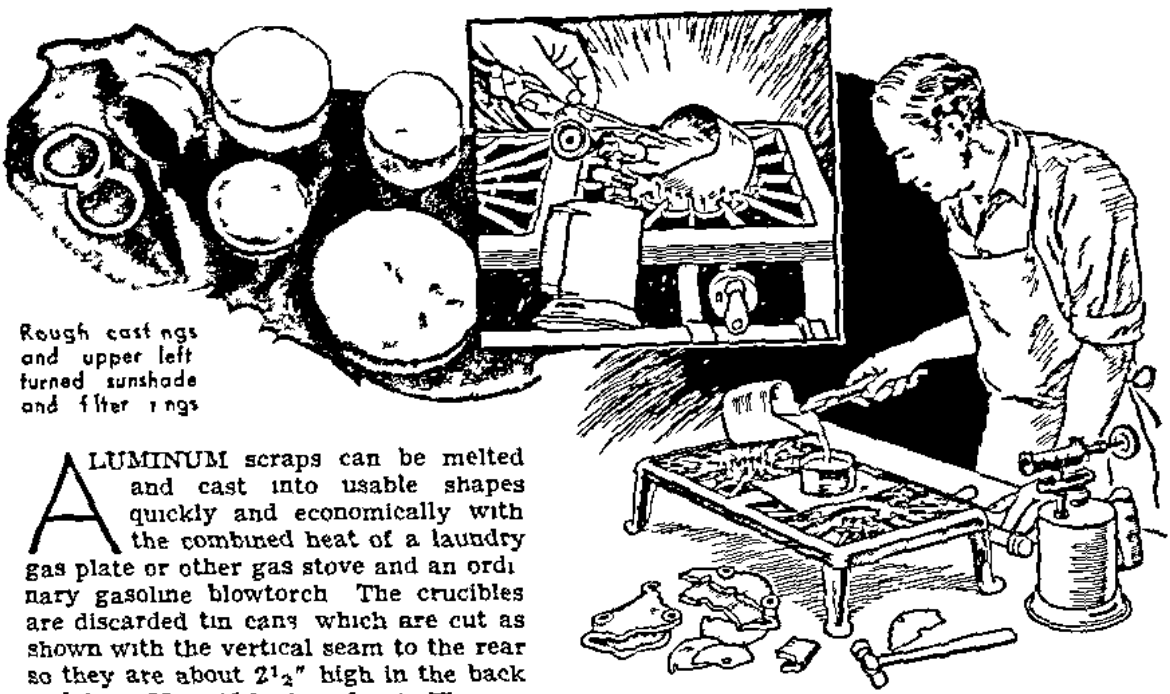




NEW SHOP IDEAS

GAS PLATE AND BLOWTORCH

Melt Aluminum Scraps



Rough castings and upper left turned sunshade and filter rings

Pouring the aluminum from the tin can crucible into a tin can mold Above how the heat is applied

ALUMINUM scraps can be melted and cast into usable shapes quickly and economically with the combined heat of a laundry gas plate or other gas stove and an ordinary gasoline blowtorch The crucibles are discarded tin cans which are cut as shown with the vertical seam to the rear so they are about $2\frac{1}{2}$" high in the back and from 3" to 4" high in front The can is set over the burning gas jet on an angle so the high side faces to the front

The lighted blowtorch is set against the gas plate frame and in the majority of cases will stay there without being held The flame of the torch is directed to the inside of the tin can and aimed at one side so that it will swirl over the aluminum Small bits of aluminum scraps are added, and the heat melts them very quickly

Round aluminum stock for turning may be cast in discarded tins in various shapes and forms It is advisable to direct the flame of the torch on these tins a short time prior to pouring the molten metal

Oxidation will occur unless the molten metal is stirred constantly but it does no great harm as pure metal will pour from the bottom of crucible leaving the oxidized metal in the crucible One necessary warning is to use only pure aluminum in the tins as various other similar metals cause the tin itself to melt A cast iron crucible can be used successfully if available, but will take longer to heat

Castings used in turning parts for small motors camera fittings and the like have been made by this method up to 4" diameter and 4" high and plates up to 1" thick and 5" square —CHARLES H GOTTWALT

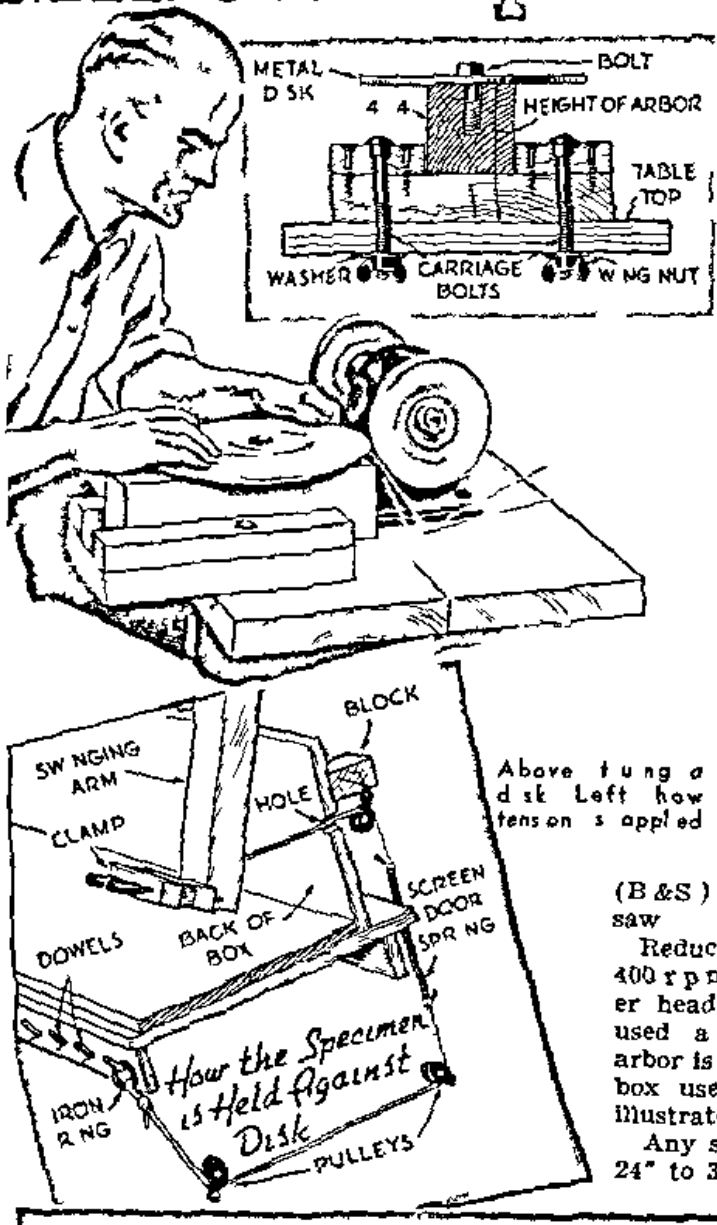
Bronze-Welding Broken Gears

WHEN a broken gear tooth has to be built up by bronze welding chip off what is left of the tooth and undercut the gear rim about $\frac{1}{8}$" If two or more adjacent teeth are involved follow the same rule but also remove one third of both connecting sound teeth so as to strengthen the patch and ease the milling operation —H J C

Mineral Specimen Saw

By W T BAXTER

Instructor of Jewelry and Gem Cutting
Woodrow Wilson High School
Washington D C



Above tung a disk Left how tension is applied

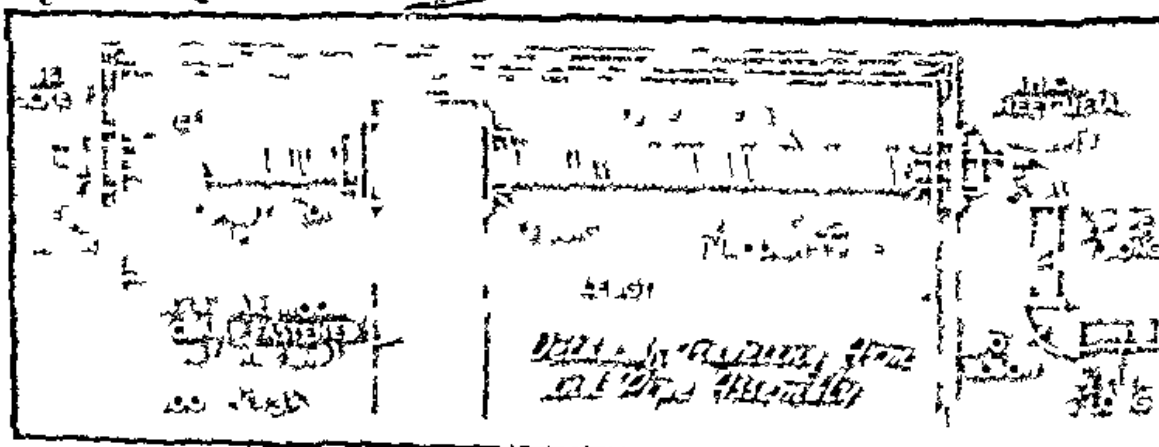
ROCKS and mineral specimens can be sectioned on this easily built saw into slabs of any desired thickness for exhibition scientific purposes or for grinding into semi precious gem stone cabochons

The saw can either be a diamond charged disk (P S M April 38 p 90) running in kerosene and lubricating oil or a plain steel disk running in a mixture of silicon carbide grit, No 100 mesh and water to which a little fine clay flour has been added If silicon carbide grit is used be sure all bearings are protected

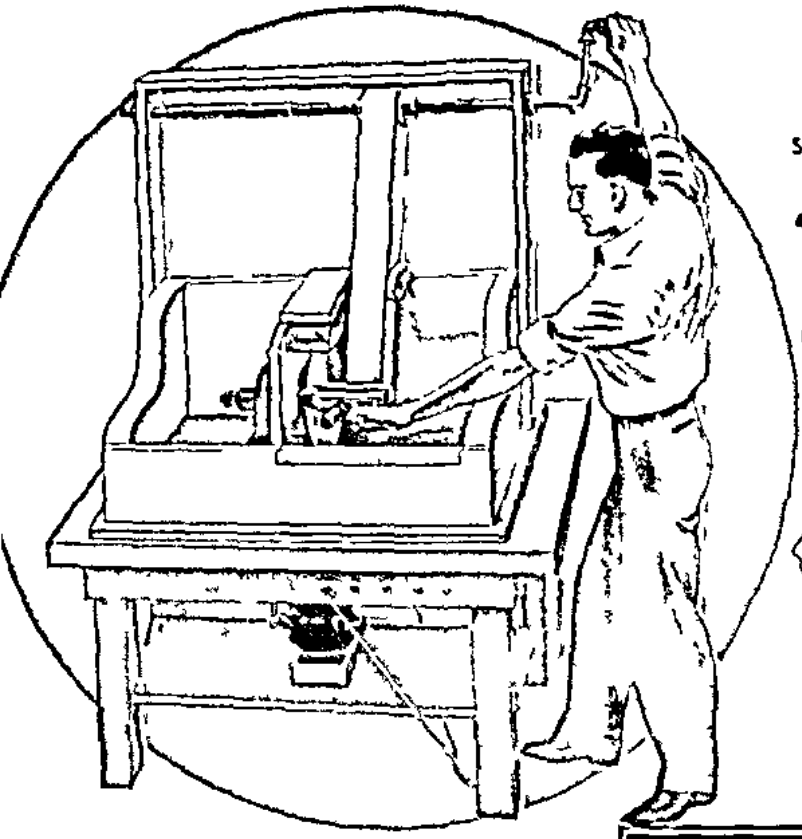
A disk 10 or 12" in diameter is satisfactory for most purposes Galvanized iron 22 or 24 gauge may be used for the grit saw but a hard steel disk of 20 or 22 gauge (B &S) is required for making the diamond saw

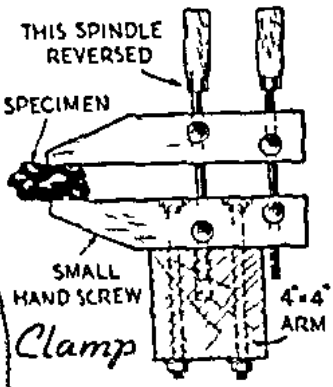
Reduce the speed of the arbor to around 400 r p m Where a bench type buffer grinder head or a so called saw mandrel is used a countershaft will do this If the arbor is mounted directly on the side of the box use a large pulley Both methods are illustrated

Any size box can be used but one from 24" to 36" in length and about 24" wide is

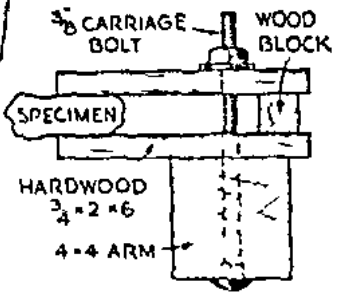


The thickness regulator at top Pipe and fittings cost 75 cents threading $1 and welding 75 cents





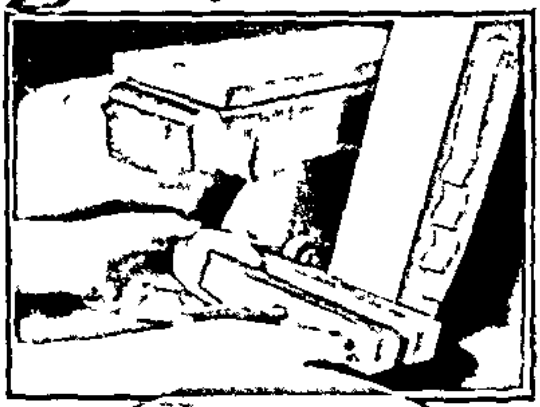
Clamp



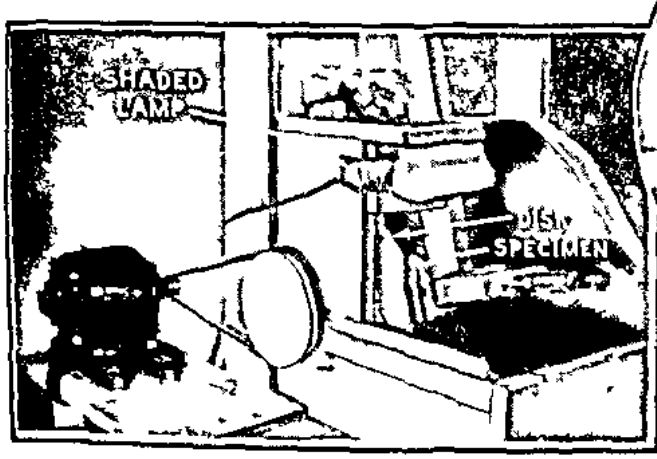
Alternate Method of Holding Specimen

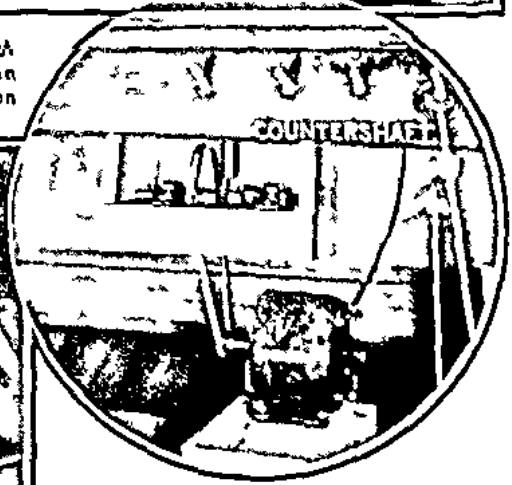
usually large enough Mount the box on a suitable table Build a well into the box underneath the disk for the abrasive or oil If grit is to be used, line the box with galvanized iron or preferably copper Tin is a suitable lining for the diamond saw because oil is used Shield the top of the box directly over the disk to avoid splashing A light built into the box to illuminate the saw is handy

In making the pipe assembly for the top have the large pipe welded onto the small pipe The weld should be ground down below the level of the large pipe The right-hand end of the large pipe



At right above cut groove in specimen before applying tension





Above countershaft mounted under table
Left machine with arbor on side of box

must of course be threaded to fit the flanges

Tension is applied to the arm to hold the specimens against the blade by means of a *screen door spring small rope and pulleys* Hold the specimen against the blade until a shallow groove is formed before applying tension Note the wooden ratchet for holding the arm forward while clamping or traversing the specimen

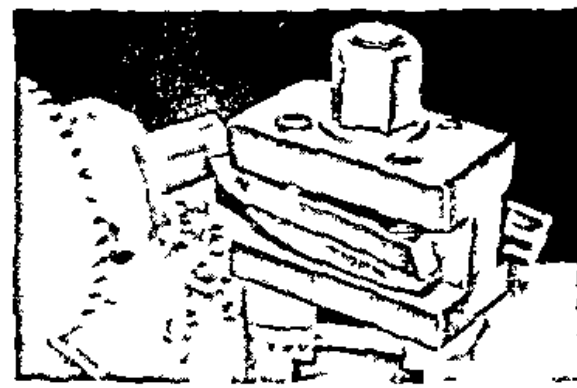
When the saw is in operation a cloth is hung in front to prevent splashing Two hooks for this purpose are soldered on the front of the shade over the lamp They can be seen in the photo which shows the first step in starting to cut a specimen The saw cuts from the top toward the bottom of the specimen

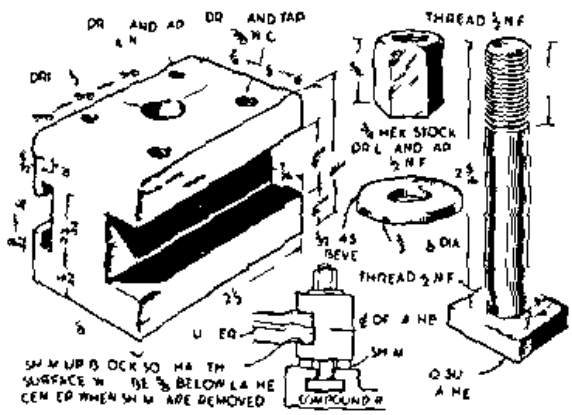
The sawing disk must be true A quick method of truing a bumpy disk is shown at the beginning of the article The saw pivots on a bolt dropped through the arbor hole into a hole in a 4 by 4" sliding block and the block is pushed forward until the blade touches an abrasive wheel *If the sliding* block wears or fits too loosely soak it in water a few minutes before using A wet sponge held on the disk near point of cutting will prevent burning

Slotted Lathe Tool Post Stays in Adjustment

ONE advantage of the lathe tool post illustrated is that it holds the cutter bits at *the proper height and when the position* of the tool is changed the height does not have to be readjusted In addition it eliminates the necessity for tool bit holders

To slot the tool holder drill a ½" hole through it as shown and clamp it to the *compound rest with the holding stud* An end mill is placed in the headstock and the block is shimmed up so that the bottom of



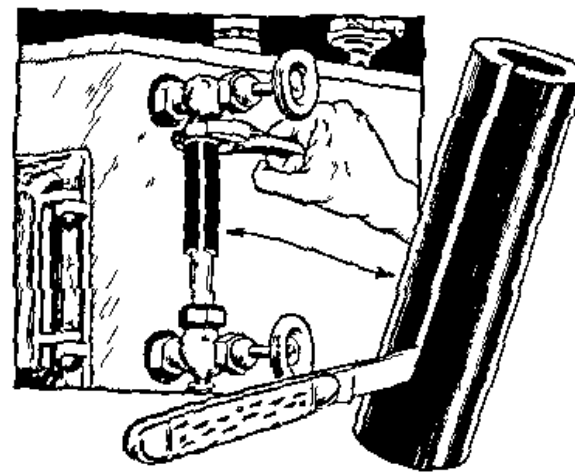


The large slot in the holder is used for various turning tools and the other slot for a parting tool

the milling cutter will cut a slot that will be ⅝" below the center line of the lathe when the block is later clamped directly to the compound rest without shims

The slot on the other side for holding a parting tool is cut in 7/32" deep with a 7/16" end mill Its height depends upon the lathe on which the holder is to be used Next insert a ⅛" key seat cutter and mill this slot as shown

The tool bits are held with hollow head safety set screws The regular tool post wedge is used to adjust the height of the cutter bit



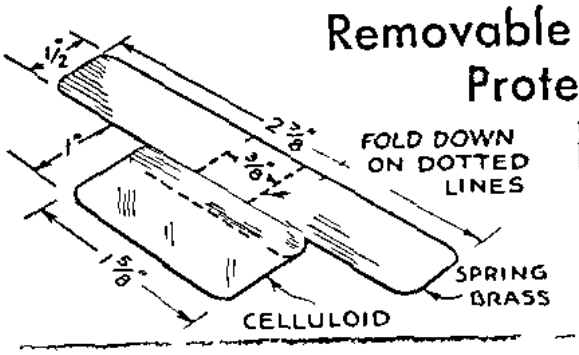
Hose Prevents Breaking New Gauge Glass

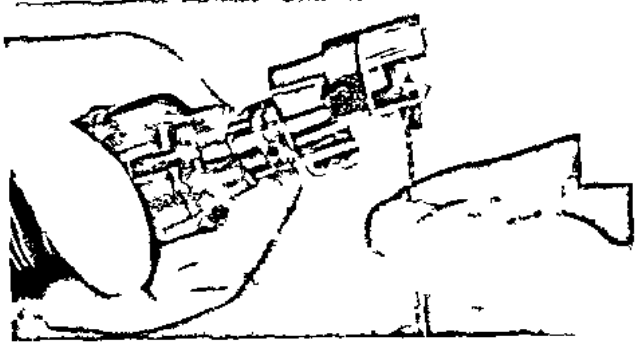
WHEN the glass tube of a water or steam gauge is being replaced *it pays to protect* it with a slit length of rubber hose This is pushed to the end where the wrench is being applied and prevents breakage in case the wrench slips

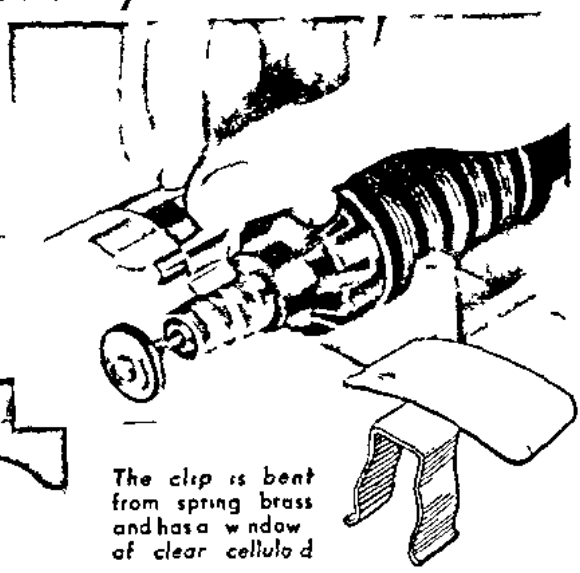
• • •

THE cutting edge *of a carbide tipped tool* should never be as thin as if the tool were made of high speed steel —H J C

Removable Guard on Hand Grinder Protects Eyes from Grit



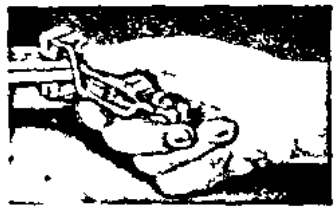




The clip is bent from spring brass and has a window of clear celluloid

MADE for use with abrasive wheels on high speed hand grinders this little guard will protect the eyes from flying particles It is cut from thin spring brass to the shape shown and the clips are bent to grip the chuck sleeve firmly Approximate dimensions are given but slight alterations may be necessary to adapt the guard to other style grinders A piece of clear celluloid or cleaned photo film stock is cemented to the metal extension When the cement has set, the metal is bent —H H

Battery Clips Serve as Clamps



EXCELLENT clamps for gluing model parts or other small work can be made from battery clips of the type shown These have strong jaws and will hold firmly any work within their capacity To protect the surface provide each clip with a pair of wood blocks slotted to fit over the edges of the jaws

FORGE WELDING, PART 1 [METAL WORKING]

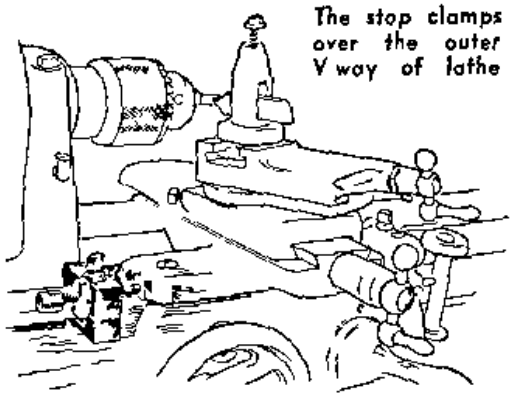
1 A clean fire, free of ash and dirt, is required It should be built from a good grade of soft coal well coked that is with all the oils heated out of it The fire must be packed down, and all coke broken into small pieces

2 Both pieces of metal must be evenly heated and both brought to a welding heat at exactly the same time Welding heat is determined by watching the flame over the fire for 'steel stars' seen coming from the pieces being welded

3 As soon as welding heat is reached the pieces must be handled quickly before the metal has chance to cool Be sure that both pieces are sparking On way to anvil, tap both pieces gently to jar off any dirt sticking to them

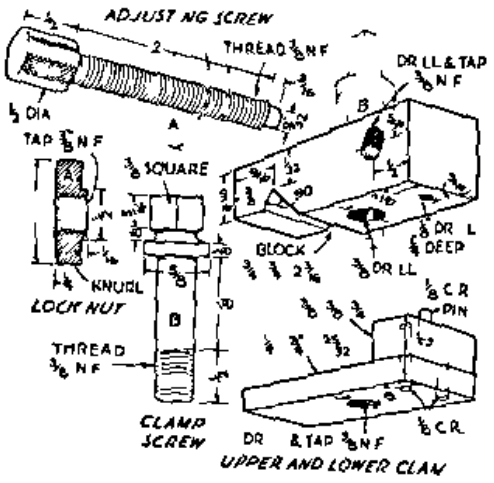
4 Overlap pieces on the anvil in the position in which they are to be welded and *tap gently* at first with the hammer As the pieces cool, increase the hammer pressure

POPULAR SCIENCE MONTHLY SHOP DATA FILE



Simple Adjustable Stop for a Lathe Carriage

THIS adjustable lathe carriage stop which clamps on the outer V way of the lathe as shown is a useful accessory The upper half is cut from a piece of ¾ by ¾" by 2 3/16 stock The lower clamp is a piece ¼" by ¾" by 1 25/32" to which is riveted a piece of ⅜ square stock The clamping screw is turned from ⅝" cold rolled stock the adjusting screw from ½" stock and the lock nut from 1" stock Note the dowel pin —A S BLOOM

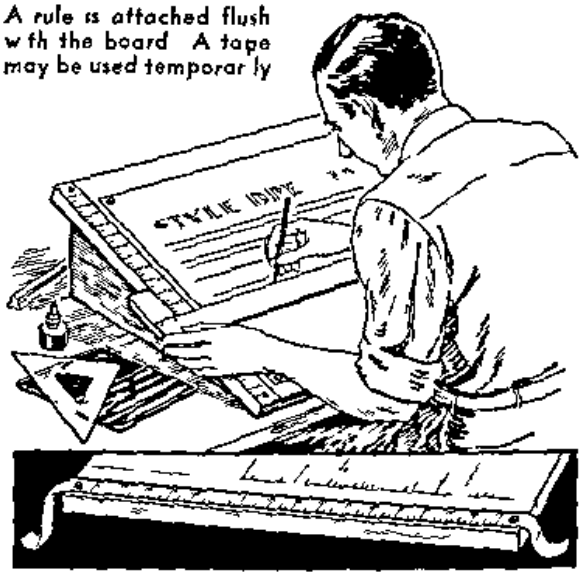


Scale on Drawing Board Is Aid in Drafting

IN CERTAIN types of drafting where many horizontal lines have to be ruled it saves time to attach a transparent celluloid rule to the board with short countersunk wood screws The left hand edge of the board is first sanded to a depth corresponding to that of the scale used A second rule may be placed along the top edge of the drafting board if desired

As a temporary expedient a dressmaker's cloth measuring tape may be held in place with thumb tacks Do not however try to use the cloth tape continually for it will soon wear out —E T ORCHARD

A rule is attached flush with the board A tape may be used temporarily

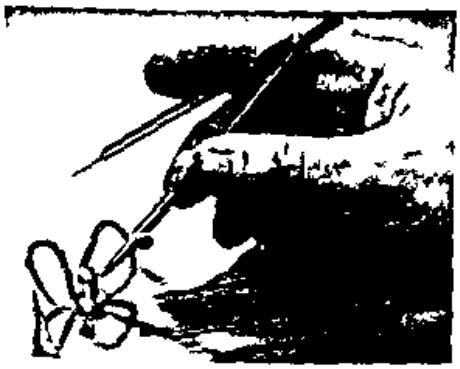


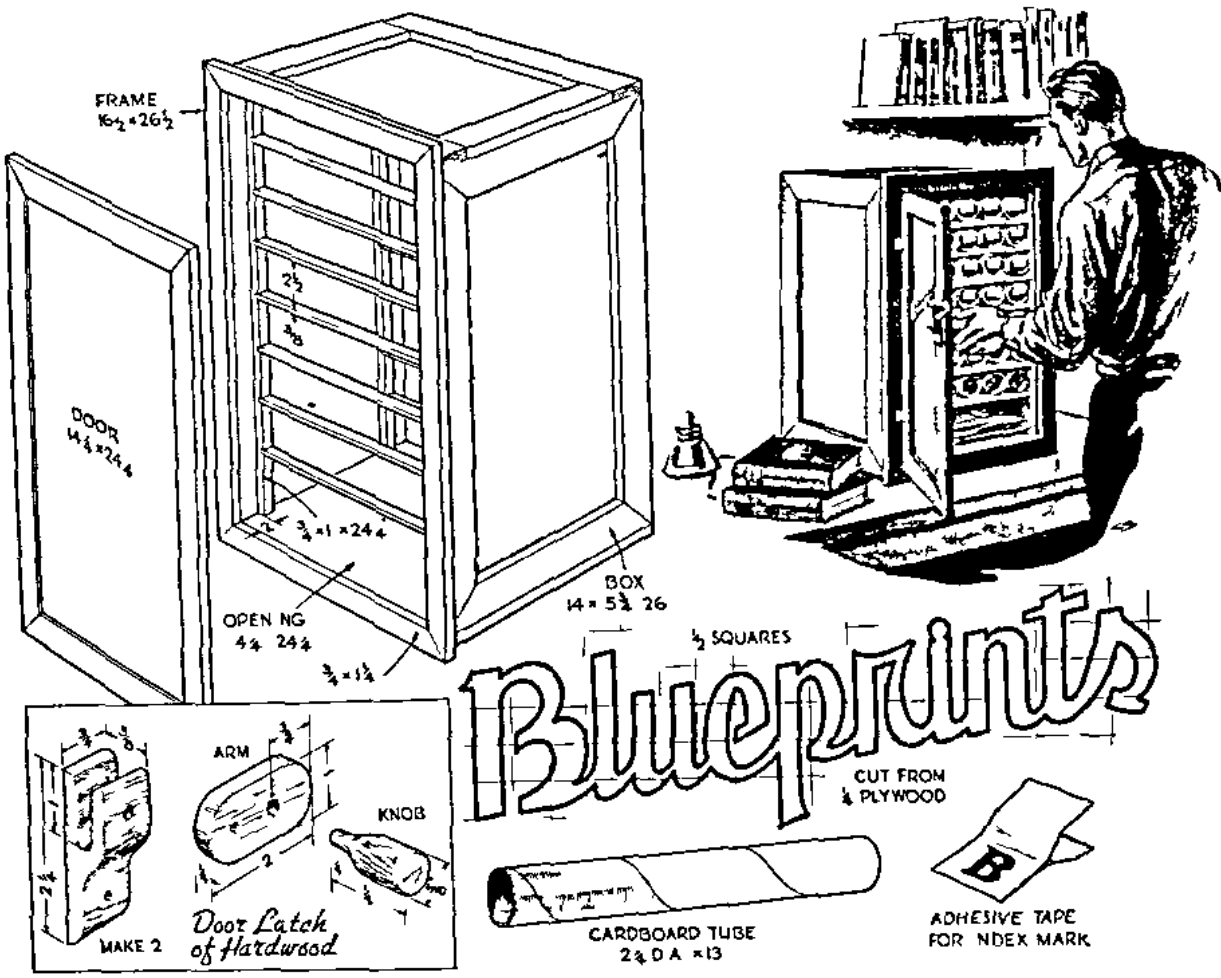
Restoring Burred Threads

ONE method of restoring a burred thread on the end of a shaft or bolt is to use an extra nut of the same pitch Saw this in half and clamp the halves on the thread back of the portion that has been damaged Apply a heavy oil then screw the half nuts out towards the end —C H

Pipe Cleaner Pinned to Board Serves as a Pen Wiper

FOR cleaning either ruling pens or ordinary steel pens a pipe cleaner is much more convenient than a cloth The cleaner can be fastened to the corner of a drawing board with a push pin as shown at the right One movement with a drawing pen removes all the ink The cleaner is easily removed and another substituted when it starts to become dirty from use —O E





Blueprint Cabinet Built from a Packing Case

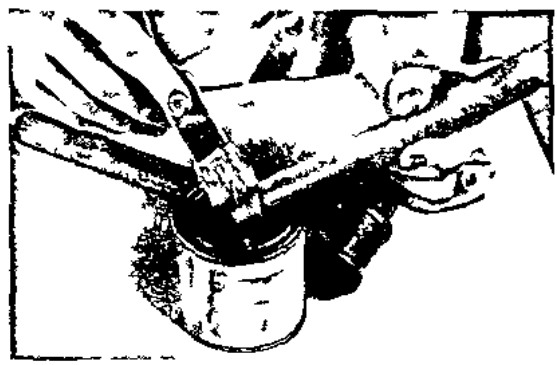
EVERY shop requires a place to keep the blueprints drawings and flat plan sheets that are bound to accumulate A neat roomy cabinet for this purpose may be made from an ordinary plywood packing case Measuring from one end mark off a section 15¾" wide 14" deep and 26" high and cut this out Then from the material left over cut a fourth side and nail it on so the whole forms a small box.

Two ladderlike sets of spacers 1" wide are next prepared the sidepieces being ¾" thick and the crosspieces or shelves ⅜" These are inserted near the front and the back of the box as shown A door frame of ¾" by 1¼" stock is also made and nailed on the front of the box and a door is constructed to fit A wooden latch for locking the cabinet can be added

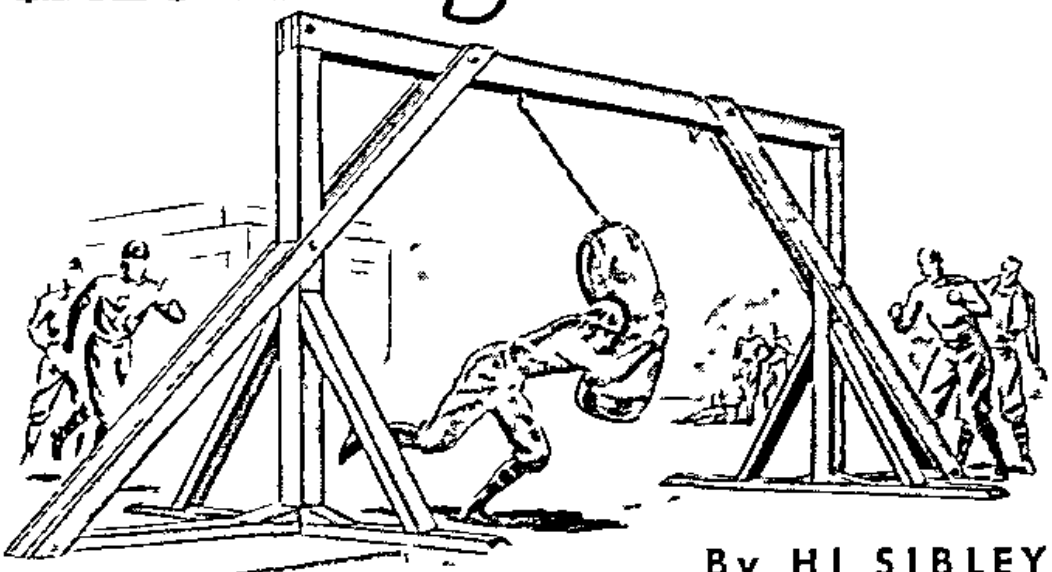
The cardboard tubes for holding the blueprints are 2¼" in diameter and 13" long with adhesive tape labels The index is lettered or typewritten on paper and tacked inside the door —CHARLES JEGLINSKI

Cement and Linseed Oil. Seal Pipe Joints

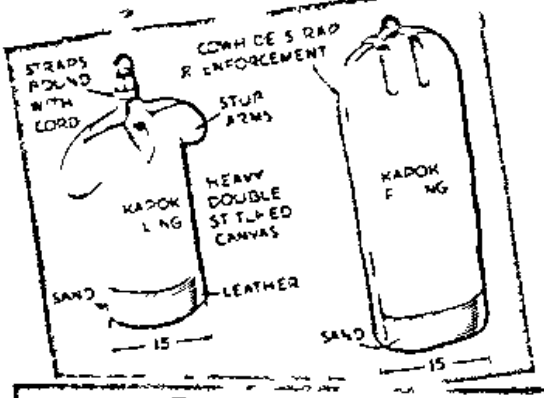
ONE plumbing firm saves money by sealing water and steam pipe joints with a mixture of Portland cement and boiled linseed oil This has been found as satisfactory as the usual lead mixture There is always much unavoidable waste of any pipe cement but with the cheaper mixture this is no longer of much consequence —R O L



Tackling Dummies

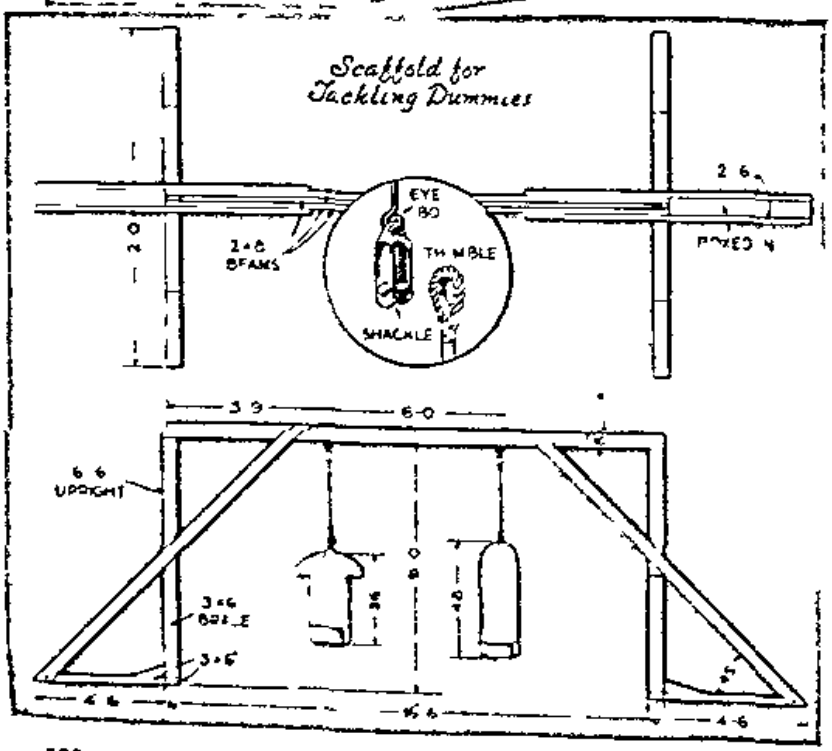


By HI SIBLEY



TOUGH materials and heavy reenforcement are essential in making tackling dummies for a football squad Athletic coaches usually have favorite designs to suit their own special training technique, but the accompanying illustrations show two types adaptable to all around use

Each dummy is made of heavy canvas with a leather boot on the bottom The ring for suspension is secured with leather straps double stitched as indicated. The bottom is filled with sand to the required weight, and the upper part is stuffed with kapok or similar upholstery material that will not pack



One coach suspends two dummies from a scaffold as shown in the drawings, one of them with about half as much sand weight as the other The rope should be hung over a thimble unless a spring or pulley suspension is preferred. The scaffold timbers are of the dimensions given, assembled with ½" carriage bolts This particular design is very sturdy, and has been in use by the champion Pasadena (Calif) Junior College

AND OTHER FOOTBALL TRAINING EQUIPMENT

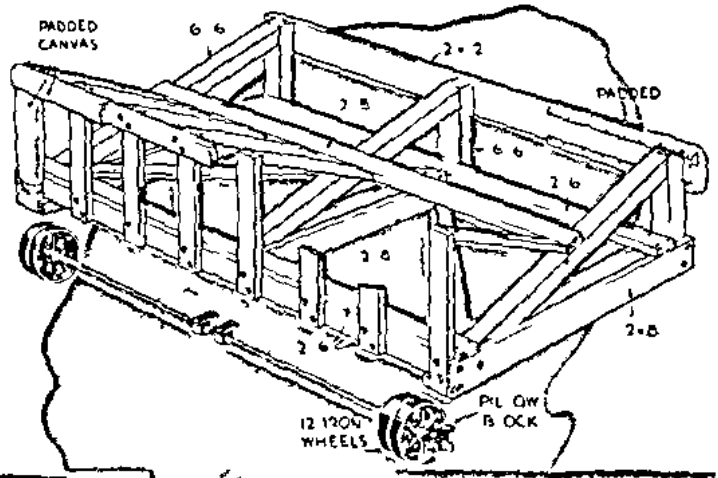


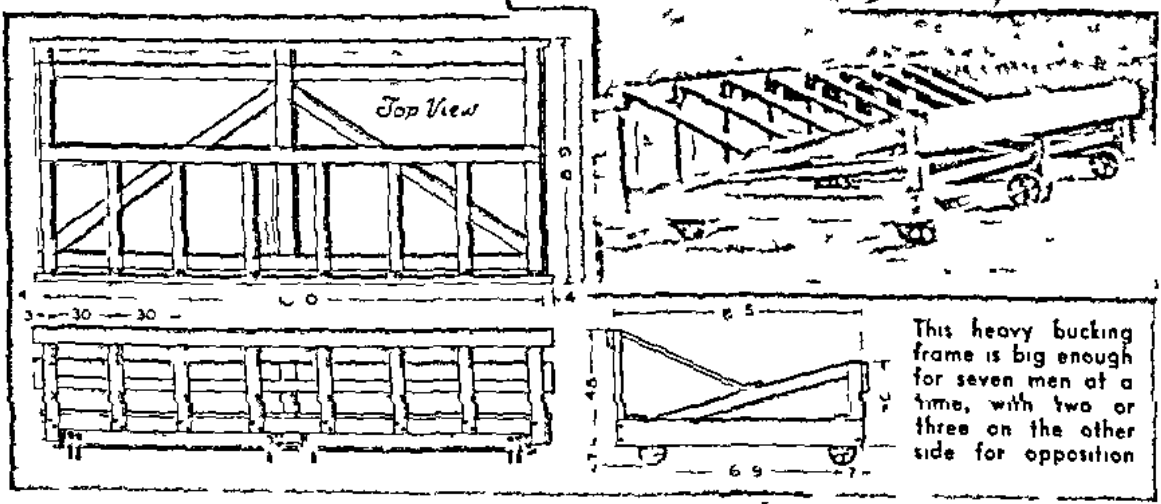
team for several seasons with great success

The same team uses the bucking machine shown in other illustrations It is built of heavy timbers assembled with ½" carriage bolts and mounted on six pairs of iron cultivator wheels The axles turn with the wheels and are mounted in stock pillow blocks (plain bearings), which can be obtained from a hardware dealer or mail order house The corners of all exposed timbers should be rounded to prevent injury from splinters The up rights are padded as are the long horizontal members on each side A slate gray is the most suitable color for painting the framework

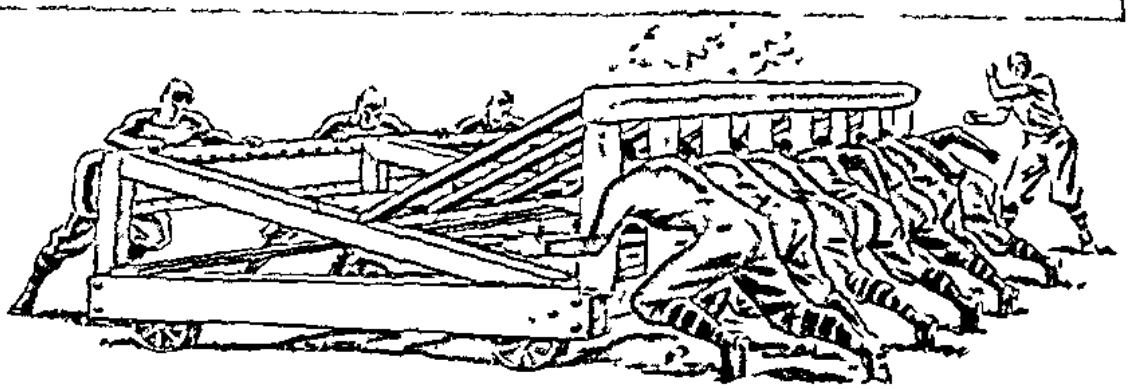
Naturally, such a huge device is not intended to be pushed easily With its great weight, only two or three men are required on the defensive side to give the seven forwards a thorough workout The machine should be used only on hard, dry ground because the wheels would bog down in the mud in wet weather

This equipment is used by a team averaging about 180 lb For lighter grammar or private school teams smaller timbers may be used such as 4" by 4" or 5 by 5 instead of 6 by 6"





This heavy bucking frame is big enough for seven men at a time, with two or three on the other side for opposition



Cheese Bait Is Improved by Cooking with Match



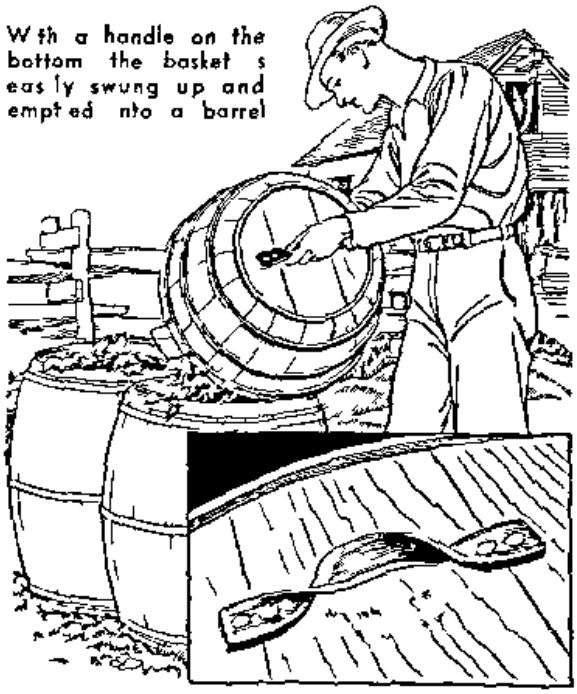
FISHERMEN who use commercial fish bait of the type made from cheese often find that it dissolves quickly in the water or be comes dislodged from the hooks be cause of its crum bly nature To pre vent this one fish erman says that it is necessary only to mold the bait on the gang hook in the usual manner then hold it in the flame of a lighted match to sear the cheese around the outs de

This cooking he claims gives the bait a rubbery consistency so it stays firmly on the hook and also seems to make it more attractive to the fish



Angleworm Bait Carried in Old Storm Rubber

A DISCARDED storm rubber being noise less and free from sharp edges serves much better than a tin can to carry angleworm bait in a boat It is placed flat upon the boat seat for selecting the worms but at other times it hangs from a nail or hook where it is out of the way —G H



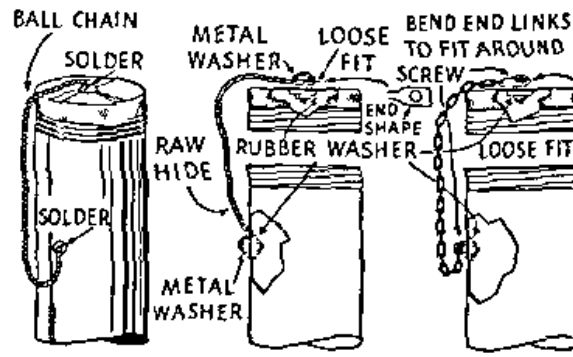
With a handle on the bottom the basket s eas ly swung up and empt ed nto a barrel

Handle Under Bushel Basket Helps in Emptying It

FARMERS and gardeners will find that a leather or rubber strap if attached to the bottom of a bushel basket will aid in emp tying the contents into bins or barrels The strap should be twisted once before the ends are riveted in place as this makes it easier to insert the fingers

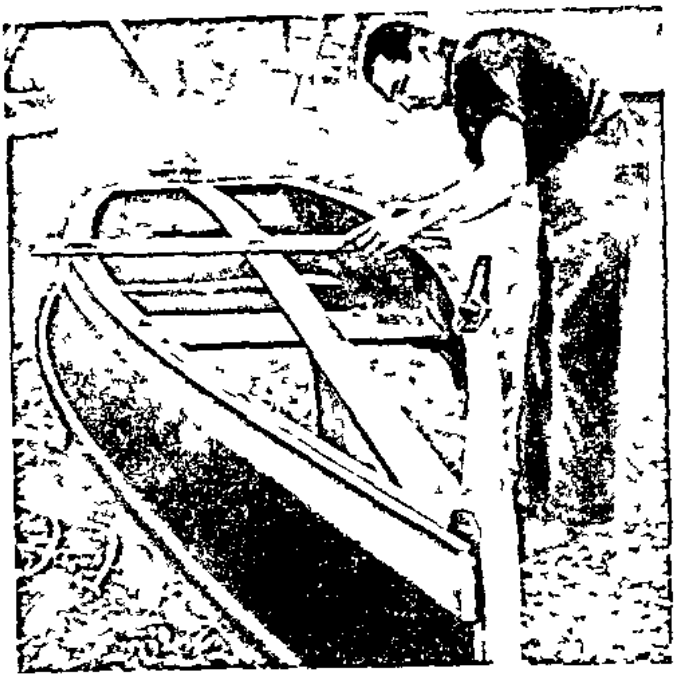
Easy Ways to Fasten Cap to Fishing-Rod Case

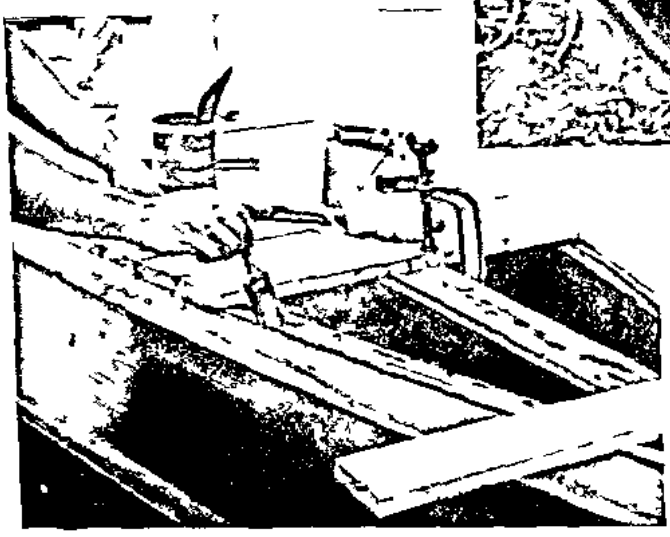
THE caps of aluminum fishing rod cases are all too easily lost or dropped overboard This can be prevented by the simple ex pedient of fastening the cap to the case by one of the three methods illustrated below Note the swivel arrangement required for rawhide or link chain ball chain does not require this Use soft rubber washers as shown to insure water tightness at the connections —R. C R



Replanking A FLAT-BOTTOMED Rowboat

By Bruce and Willard Crandall





Plane the surfaces of the chines and side planks perfectly smooth Left use cotton wicking soaked with marine glue or white lead to make all the seams water tight

NO SPECIAL skill or knowledge of boat building is required to replace the bottom of an ordinary flat-bottomed rowboat, provided the sides and other parts of the boat are in good enough condition to make the job worth while. In most cases the materials will cost less than five dollars

In the boat shown the chines as well as the entire bottom outside keel and skeg had been destroyed by marine borers so it was essential to put new chine pieces on the outside of the boat. Ordinarily this would not be necessary

Excessive swelling of the planks is one thing to guard against because it causes buckling and leaks at the chine This is likely to result from the use of material that has been too well seasoned or kiln dried It usually can be minimized by using narrow planks, 4" or less, and by not forcing them tightly together White cedar and cypress are generally the most satisfactory woods, although other woods such as red cedar, spruce, fir, redwood, and yellow or white pine often give very good results

After the old planking has been removed the edges of the side planks and chines should be planed smooth Keep them flat so that the planking will fit perfectly It is usually best to start laying the planks in the middle, but check first to see how well they come out at the bow and stern

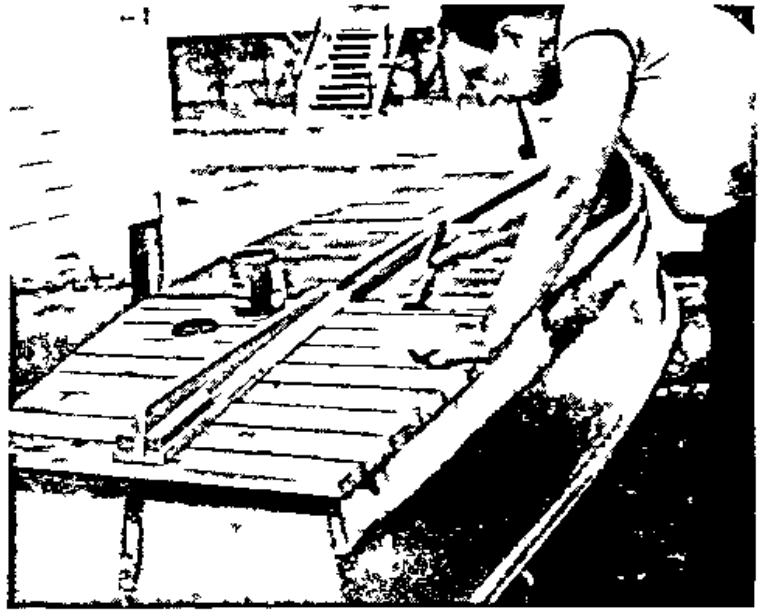
Before the planks are put in place, a couple of strands of cotton wicking should be laid along the edge of the chines and transom The wicking and the edge of the side plank chine, and transom should be coated with marine glue, soft white lead, or thick paint. Lay a similar strip of cotton wicking on the edge of each bottom plank before the next plank is put in place

The bottom planking should be fastened to the chines and side planks with brass or galvanized screws or galvanized nails, spaced about $1\frac{1}{2}$" apart. The planks should be sawed off flush with the sides as the work proceeds Do not clamp or force each plank too tightly against the next one, but leave the seam open at least the thickness of a hack-saw blade You may, if you wish, determine by experiment ahead of time how much a plank of the particular lumber you are using is likely to swell and make the seams accordingly

Another way of making the bottom seams

water tight is to calk them after the planks are in place In this case the edges of the bottom planking should be beveled slightly to make a calking seam which is closed on the inside but left open about 1 16 on the outside to receive the calking later

If the bottom planks fit perfectly it is often not necessary to have any kind of calking or anything whatsoever between the seams of a flat bottom boat Planking less than $\frac{5}{8}$" should not be selected unless some special type of construction such as batten seam is followed. Never use ordinary tongue and groove material If extra light weight is desired the bottom can be covered with a single piece of marine plywood $\frac{3}{8}$" or $\frac{1}{4}$" thick instead of planking Cut it with a fine toothed saw



With only a few tools anyone can install a new bottom on a flat bottom rowboat Narrow planking prevents swelling and buckling

After the bottom is in place the edges should be planed smooth and flush with the side planking and the outside keel and skeg added as desired Copper paint should be used if the boat is to be left in salt water otherwise regular marine paint will prove satisfactory



Rubber Shock Absorbers for Hedge Clippers

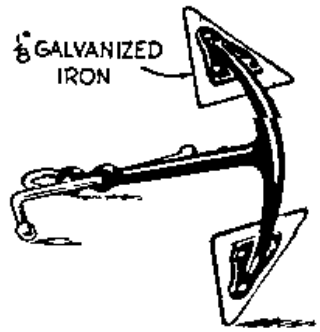
HEDGE TRIMMING shears of the type shown will not cause an annoying shock or jar to your arms if you cut two short lengths from an old garden hose slit them open along one side and fit them over the ferrules Fasten them permanently with tacks driven into the wood of the handles —G E H

Ball Aids in Throwing Rope over House Roof

WHEN it is necessary to carry a rope over the top of a house to pull up ladders and rigging or for other purposes attach one end of a fishline or kite string to a soft sponge rubber ball and the other end to the rope Then throw the ball over the roof and pull up the rope The advantage of using a rubber ball is that it is not likely to break a window pane if it goes askew when thrown awkwardly —CARL L. SAWYER

Bigger Flukes Improve Light Rowboat Anchor

TO INCREASE the holding power of a light rowboat kedge anchor saw out two triangular shaped pieces of galvanized iron about $\frac{1}{8}$" thick and about three times the area of the present flukes Then rivet them flat onto the flukes. If desired coat the anchor with aluminum paint.



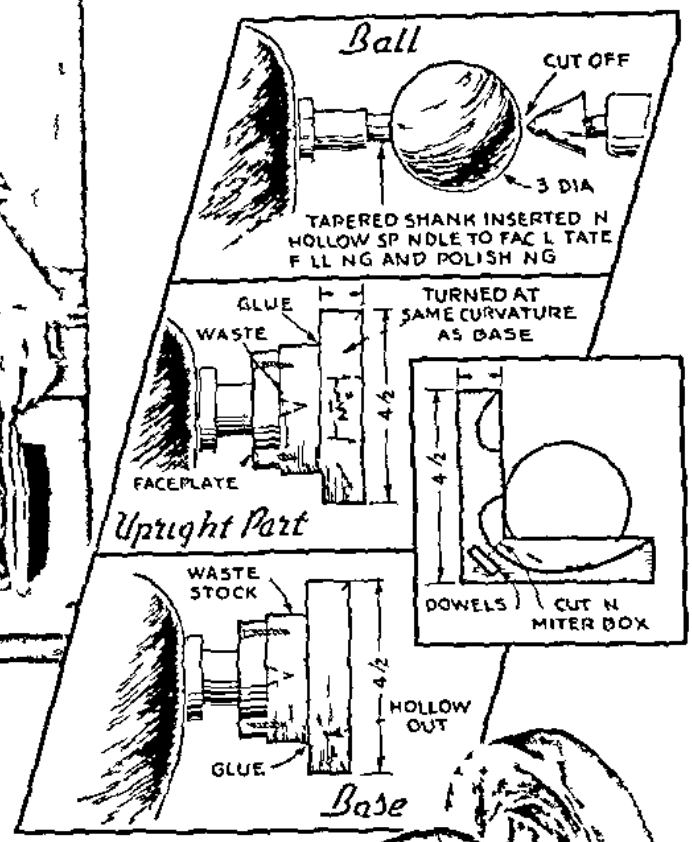
The triangular pieces increase the holding quality of the anchor

Novel Automatic Letter Holder

TURNED FROM WALNUT



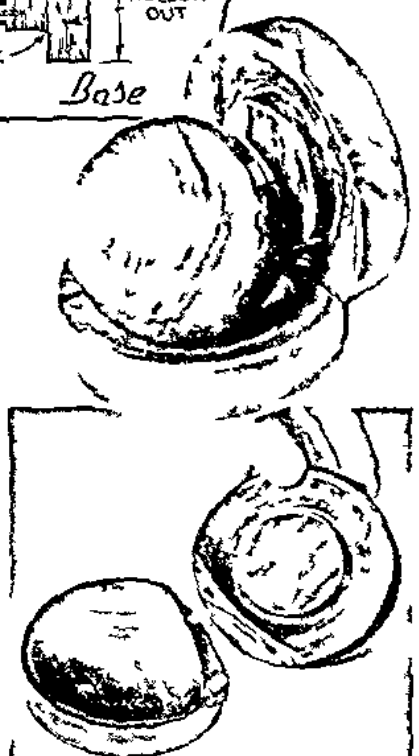
Left the letters a e held by pressure of the ball wh ch rolls n towa d the upr ght Below how the three pa ts are tu ned and assembled



THE simple lines of this mod ern automatic letter holder emphasize the natural beau ty of the walnut wood from wh ch it is turned The slope of the base block is such that it causes the ball to roll toward the core or central pa t of the upright The letters are placed between the ball and the upright No matter how many or how few letters there are they are securely gripped

Base and upright measuring 4½ " in d ameter are turned from 1 thick walnut The upper surface of the base is hollowed out and the face of the upright is turned as shown to leave a central core measuring 1½ " in diameter and practically the same thickness as the original block

Filler and shellac are applied and allowed to dry While the work revolves in the lathe the finish is rubbed down by holding against it a cloth dusted with pow dered pumice stone Then both parts are waxed The parts are next beveled and fitted together with dowels



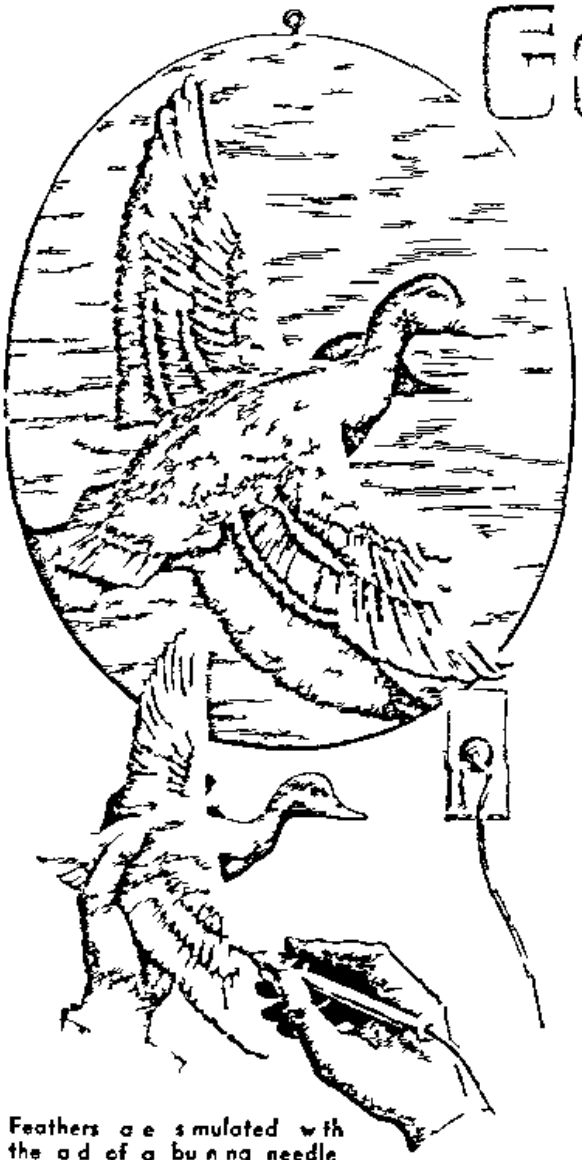
CLOCKED PROJECT
Av age T me
5 hou s

The 3" ball is turned and finished the same way Note that a tapered shank is turned on the ball and inserted in the hol low spindle of the lathe after the other waste end has been cut off This is done to facilitate filling and polishing the ball

—BENJAMIN NIELSEN

Game-Bird Plaques

IT'S EASY TO CARVE THEM IF YOU FOLLOW THE RIGHT METHOD



Feathers are simulated with the aid of a burning needle At top the completed plaque

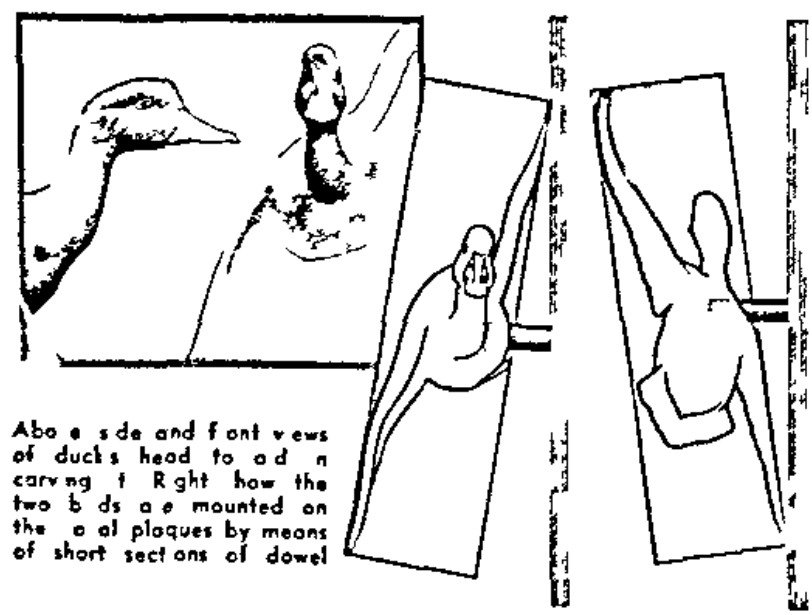
ANY amateur craftsman with a reasonably good eye for proportion and color can carve and color lifelike miniature game bird plaques

The male and female mallards illustrated are made from 2 white pine The grain should run along the wings if possible They are carved in what may be called high relief giving the impression of depth and roundness When the wings are well shaped the feathers may be indicated by carving tools or an electric burning needle The needle also helps in shaping the bill nostrils and eyes

Color plates to copy may be found in any library and sometimes helpful paintings appear on magazine covers Flat oil colors are best except for the head of the male. The peculiar iridescent green sheen of the head may be produced by applying green bronze powder over wet shellac

The female is painted a light warm brown on upper head neck, wings and body fading to a very light buff on the breast and under body The markings on the head and neck are in the form of brown dots worked into the V shaped markings of the ends of the back feathers The wing tips and the wing coverlets are dark brown fading into the warm brown The color band on the trailing edge of the wing is blue violet with white bars on each side of it The bill is a yellow brown darker on the end.

The coloring of the male is familiar to every



Above side and front views of duck's head to aid in carving Right how the two birds are mounted on the oval plaques by means of short sections of dowel

By HOWARD MUNNS



How the bird is shaped from the wooden block and method of drawing ovals Circular plaques could also be used

nature lover Yellow brown bill iridescent green head white neck band breast deep wine maroon down to just under the wings blending into warm light gray dark gray near legs with underside of tail nearly white legs reddish brown edges of wings dark brown fading to light gray to the coverlets which are warm brown fading again to light gray

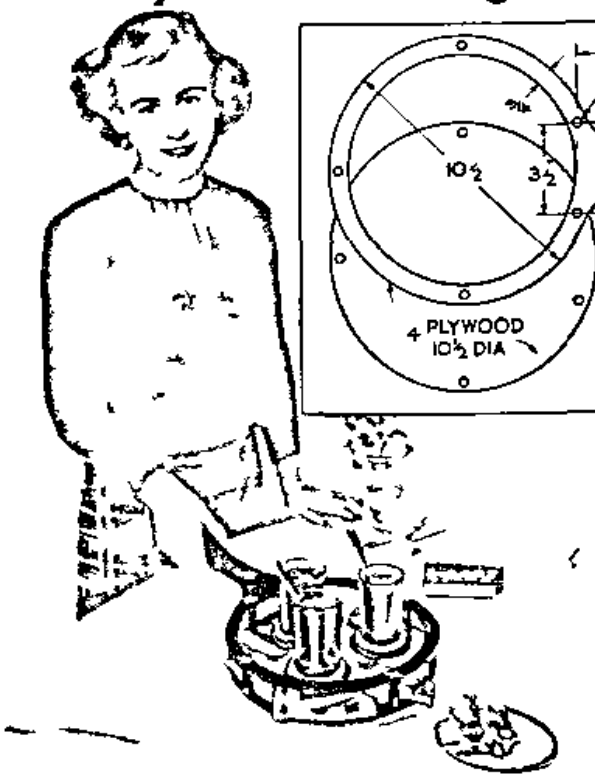
Mount the ducks on plywood panels round or oval stained lightly and finished either with a varnish that dries to a satin gloss or a regular varnish rubbed to a satin finish If however a grainless background is preferred use a neutral tinted semigloss enamel The ducks bodies are held away from the board by short pieces of dowel as shown on the opposite page A screw eye is added for hanging

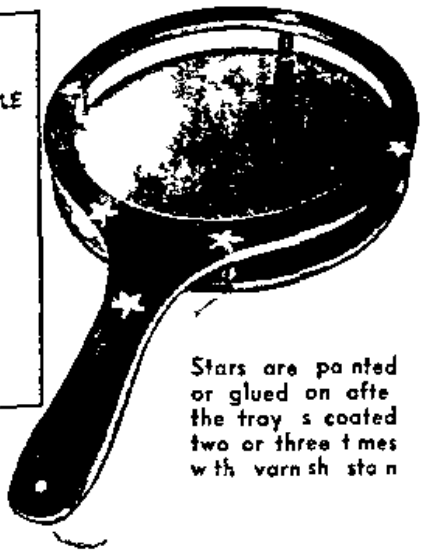
Pheasant quail and game fish would also be adaptable for this sort of craftwork and may be made in the same way



When carefully carved and painted the model presents a realistic appearance and will enhance any den Other birds and fish can be adapted to this type of craftwork

Plywood Serving Tray Is Shaped Like Banjo





Stars are pa nted or glued on afte the tray s coated two or three t mes w th varn sh sta n

DESIGNED in banjo shape this unique plywood serving tray suggests something of the picturesque charm of the Old South It would make a distinctive gift and since the construction is simple two or more of the trays could be made up at one time very quickly

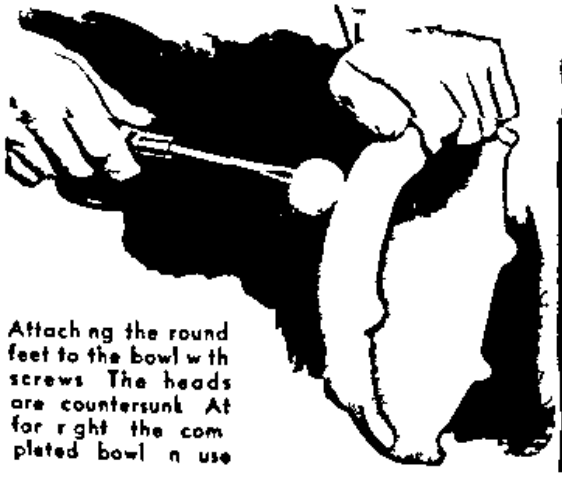
With a compass and some freehand sketching lay out the frame and bottom then saw them out together Drill the nec essary holes using caution to prevent the bit from splintering when it comes through This is best done by backing up the wood with a piece of scrap stock. The pieces may then be separated and the inside cut made

Turn all the joiners at once cut them off and clamp and glue securely Follow with a thorough sanding and any type of finish desired One method is to apply three coats of walnut varnish stain and rub down the last after it has dried for several days. Stars may be either glued on or painted — BRUCE MACINTOSH

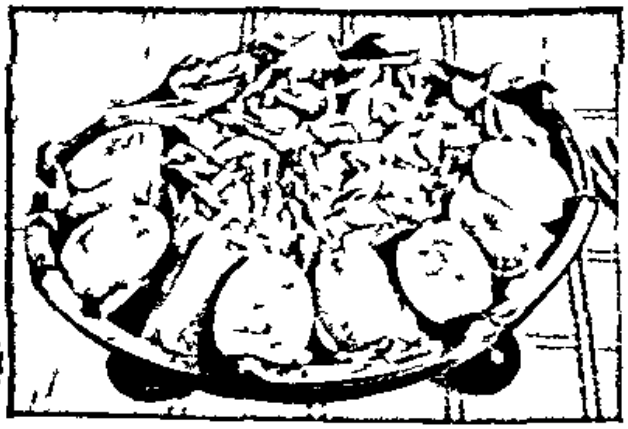
CLOCKED PROJECT
Average T me 2 Hours

Chopping Bowl Cut Down for Serving Salads

AN INEXPENSIVE chopping bowl can be transformed into an attractive salad bowl by cutting it on a jig saw to the shape shown The edges are rounded off and the whole bowl sanded to smoothness It is then mounted on three feet 1" in diameter turned from maple The tops of the knobs are sanded flat to fit the undersurface of the bowl A light varnish stain is applied for a natural golden finish —B B BRONSON



Attach ng the round feet to the bowl w th screws The heads are countersunk At for r ght the com pleted bowl n use



Print of a Child's Hand Preserved in Plaster

A PRINT of a child s hand can easily be preserved in the form of a plaster plaque Obtain a 6" wooden embroidery hoop and cut the inner hoop at one place so it will spring out when the outer hoop is withdrawn from it. Lay a board on a level solid surface and place a sheet of white paper over it Fit the cut hoop inside the outer one and lay them flat on the paper

Mix plaster of Paris with water to a thick creamy consistency and pour it inside the ring When the mixture begins to harden place the child s hand in the mold fingers extended and spaced evenly Press the fingers firmly one at a time and also press the hand itself into the plaster Hold the hand down for several minutes until the plaster is no longer sticky After the hand has been withdrawn let the plaster set for half an hour Remove the outer hoop spring the inner hoop away from the plaque and trim the paper to the size of the plaque Then let the plaster dry thoroughly

A pastel shade paint will give depth to the hand print. For hanging glue a loop of ribbon securely on the back —B P SMITH

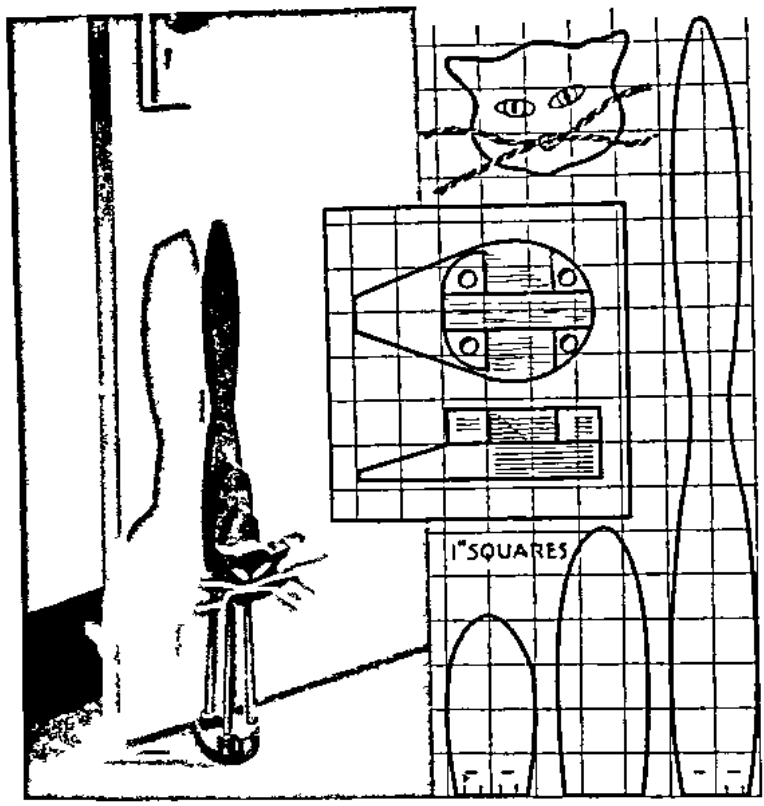


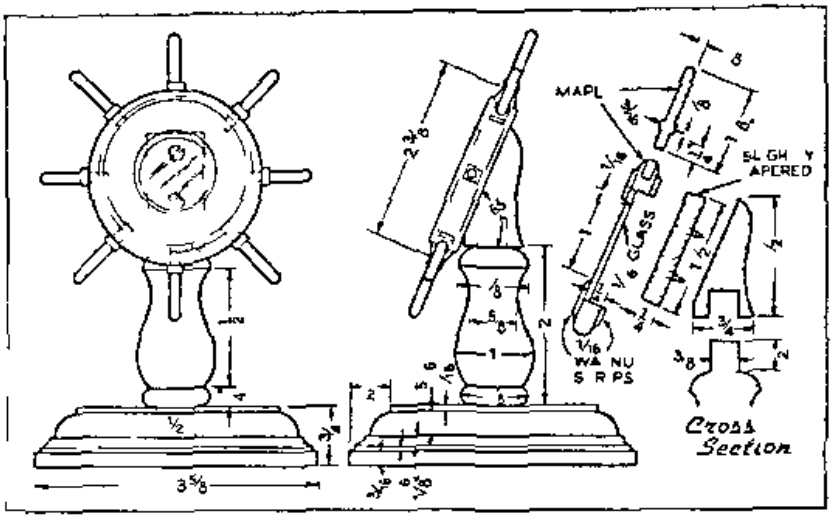
When pressed into soft plaster of Paris the child s hand leaves a clear print as at right

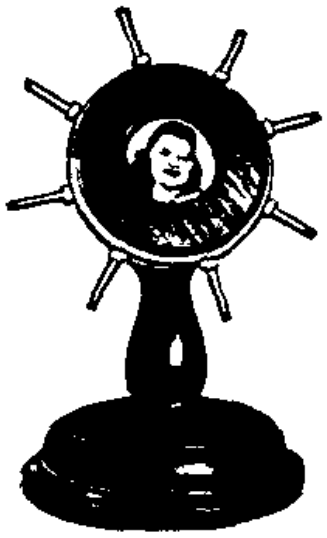
Comical Wooden Cat Does Duty as a Doorstop

NOVELTY sales appeal and economical production by amateur craftsmen were the considerations that prompted the design of this amusing black cat door stop It is another project developed at the New York workshop of the Metropolitan Junior Achievement.

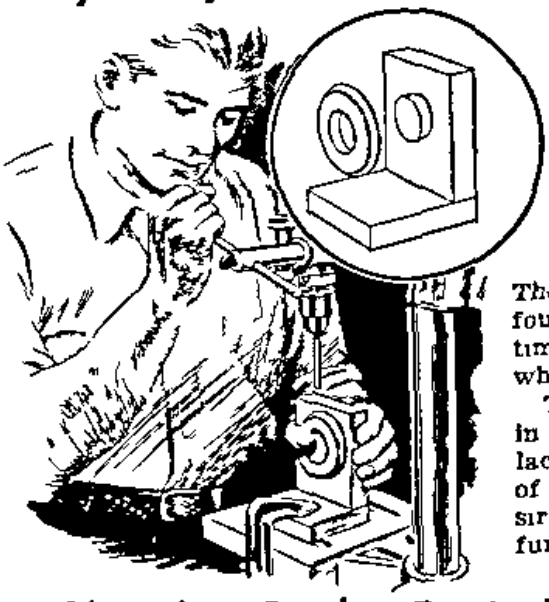
The doorstop may be readily put together from odd scraps of wood Body head tail and base are sawn from ¾" stock The legs are common ½" dowels For the whiskers pipe cleaners are used and the eyes may be painted directly on the wood or cut from white adhesive tape and marked with ink —K.S







Tiny Ship's Wheel Frames Photo



ANYONE who enjoys wood turning will find this small picture holder an interesting project to make from scraps of walnut. Although intended as a frame for a snapshot, it can be adapted to hold a watch circular thermometer or any other small round instrument. If a watch is to be set in the steering wheel may have to be a little thicker but this depends upon the thickness of the watch

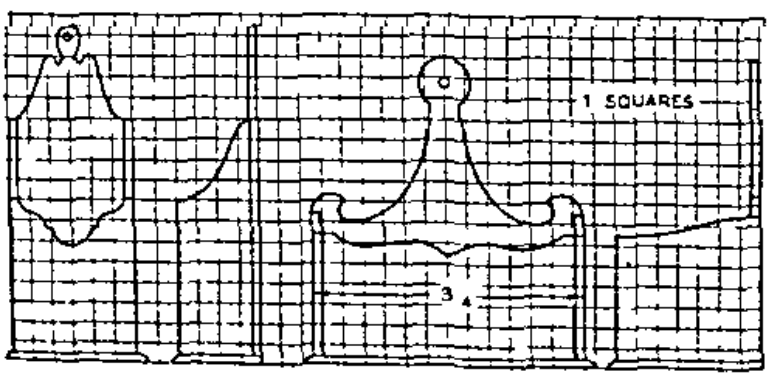
The turning is all straightaway work and it will be found easy enough to drill the rim for the pegs if time is taken to make an angle support for the wheel as shown at left

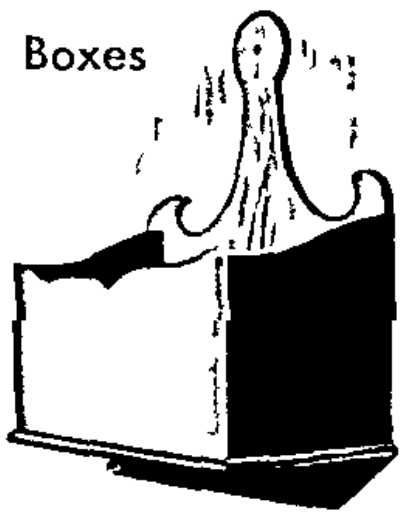
The parts can be given a high gloss in the lathe with French polish (shellac and a little oil) applied on a piece of cloth If a less glossy finish is desired rub it down afterwards with furniture wax.—MICHAEL KOLISKO

CLOCKED PROJECT
Average Time
5½ hours

Hanging Racks Copied from Pipe Boxes

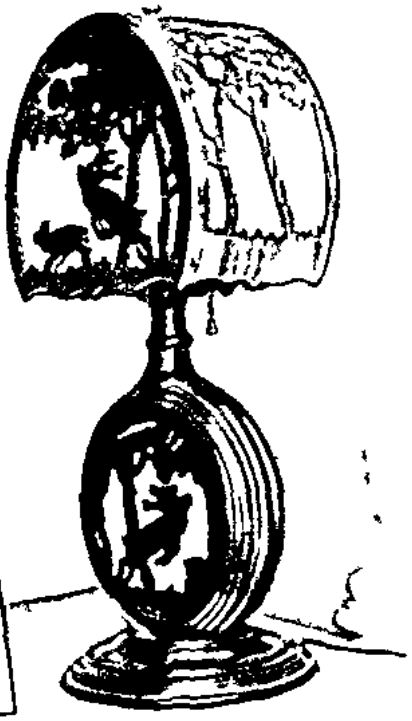
THE designs for the two boxes drawn below are adaptations of Early American pipe boxes The large box pictured in its finished form at the right is useful in the hall for gloves and scarfs while the smaller box can hold letters to be taken to the post office clothes brushes or anything of that sort The boxes are made of ½" knotty white pine —HENRY R. DIAMOND





Scarfs gloves and similar articles can be kept in the box above if hung in the hall At left drawings for the boxes





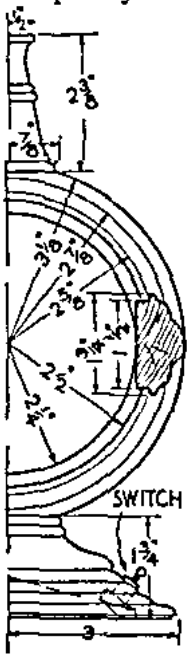


Hall Lamp

DECORATED WITH JIG-SAWED PANELS

DESIGNED for use in an entrance hallway, this decorative table lamp has a night light built into its lower section The wooden parts are walnut, although I have duplicated the lamp in both maple and mahogany with equal success

The turned parts consist of the base, which is 6" in diameter and made from 2" stock the ring $6\frac{1}{4}$" in diameter and also made from 2" stock, and the spindle, which is turned from a 2 by 2" by 3" block Cup out the underside of the base deep enough to allow for the wiring and mortise it for the toggle switch Turn and finish the ring completely before cutting out the inside, which needs only one coat of shellac or varnish to protect it from moisture Cut the rabbets to take the fretwork just deep enough to hold the $\frac{1}{8}$" wood plus the thickness of the parchment you intend to use as a backing for the silhouettes



To assemble the turned parts when finished, file a flat place on the ring long enough to contact the flat part of the base Drill a $\frac{3}{8}$" hole in the center and assemble by using a $\frac{1}{8}$" nipple $2\frac{1}{4}$" long with a $\frac{1}{8}$ nut at each end To add the spindle, flatten the center bead of the ring and bore a $1\frac{3}{4}$" hole just deep enough to set the

spindle flush on the ring or as an alternative cut a shoulder instead of a bead at the base of the spindle and carve the shoulder to fit over the beads on the ring Drill a $^{3}/_{8}$" hole through spindle and ring Attach a standard pull chain socket to a $4^{1}/_{4}$" nipple thread through the spindle and ring and lock with a $^{1}/_{8}$" nut On the inside of the ring screw a candelabra socket

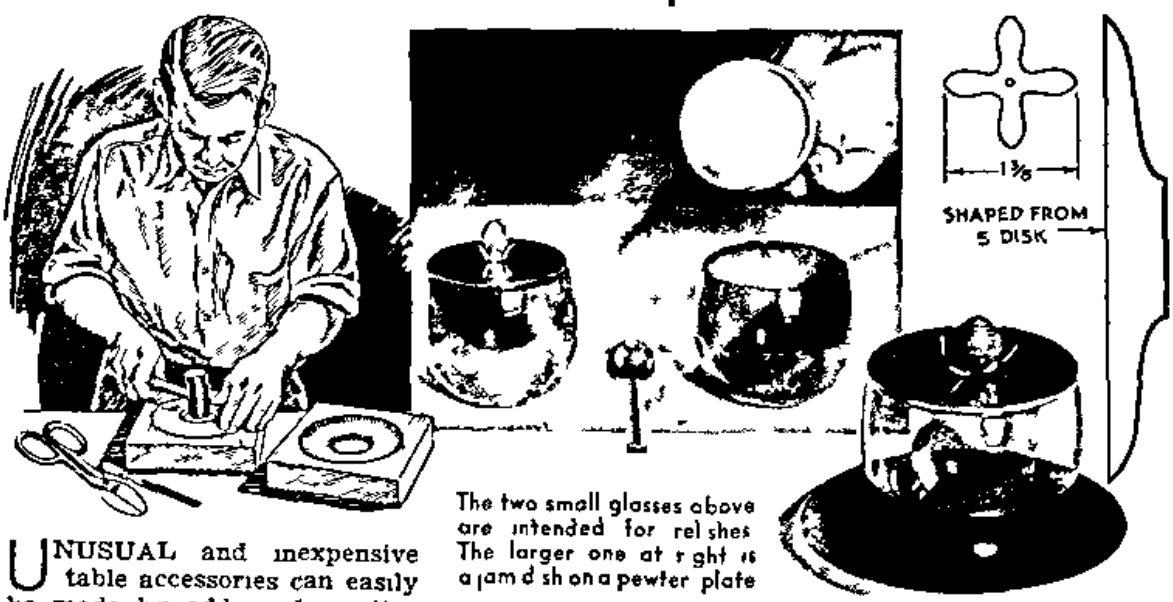
In wiring the lamp break one of the leads at the toggle switch then continue the two leads to the porcelain socket and thence to the pull chain socket. The toggle switch controls both lamps but the pull chain controls only the upper lamp Use a 7 watt candelabra lamp for the night light and a 40 watt lamp under the shade

For the bent section of the shade glue three layers of walnut veneer—sufficient for two panels $3^{1}/_{2}$ by $9^{5}/_{8}$" The flat jig sawed panels on both the shade and the base are $^{1}/_{8}$ thick walnut 8" in diameter for the shade and 5" for the base Cut the designs in all with a 30 or 40 tooth blade to get a fairly smooth edge Glue parchment or stencil paper to the base silhouettes and to the flat panels of the shade but not to the veneer panels The base panels are held in the ring rabbets with $^{3}/_{8}$" No 0 brass screws

In assembling the shade fasten three stretchers $^{1}/_{4}$" by $^{3}/_{4}$" by 3" to the flat panels where indicated by the dotted lines, and sand the projecting corners until the stretchers are flush with the curve Spread glue on the edges and on the underside of the jig sawed veneer panels Take a strip of parchment about 4" by 20", fold the end under the first stretcher and tack temporarily then pull it tight around the circumference of the shade and fasten to the third stretcher Center the two veneer panels on stretcher No 2 and nail in place Bend the veneer down and clamp the ends to stretchers Nos 1 and 3 Nail the veneer to the edge at $^{3}/_{4}$" intervals with $^{3}/_{8}$" No 20 brads Drill holes in the walnut if it is brittle Nail the veneer to the stretchers

Cut off the overhang of veneer and parchment and round the edges slightly with sandpaper Cover the joint at the top with a piece $^{1}/_{8}$" by $^{3}/_{4}$" by $3^{1}/_{4}$" Finish the wood to match the turned parts Attach a spring clip at the center of the top to hold the lamp shade —EDWARD J HOBERT

Pewter Accessories Dress Up Ten-Cent Tumblers



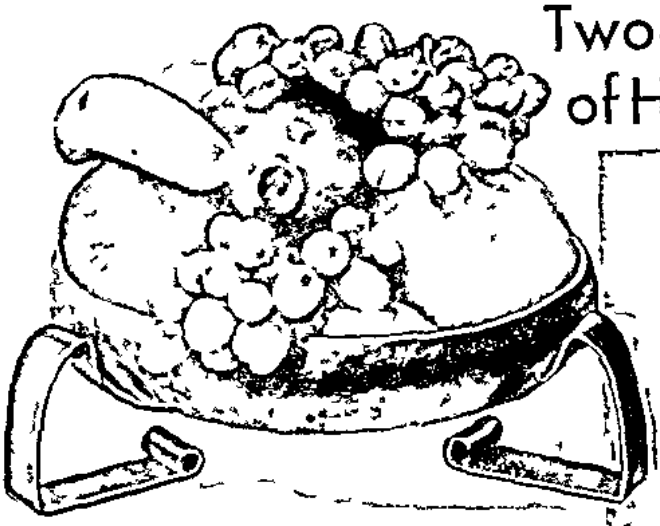
The two small glasses above are intended for relishes The larger one at right is a jam dish on a pewter plate

UNUSUAL and inexpensive table accessories can easily be made by adding decorative pewter tops to blue tumblers from the 'five-and ten Eighteen gauge pewter is cut into disks 1/16" larger than the top of the glasses A strip $^{1}/_{8}$" wide is then shaped to fit inside and soldered to the disk Take care not to melt the pewter Smooth the joint with emery cloth and polish all with 00 steel wool Use blue beads for the knobs Cut pewter as shown and shape to fit around the bead The top finial is made by melting a bit of pewter and thrusting a short length of 16 gauge copper wire into it The wire is then threaded through the bead and the pewter Bent down and soldered to the underside of the lid it holds the knob firmly The realistic strawberry knob on the larger jam dish is a dress button also fastened by a copper wire threaded through its eye and soldered under the lid

CLOCKED PROJECT
Average Time
6½ hours

The plate is made from a 5" pewter disk and shaped on wooden forming molds with a rawhide mallet.—M. S HOPKINS

Two-Toned Fruit Bowl of Hammered Copper



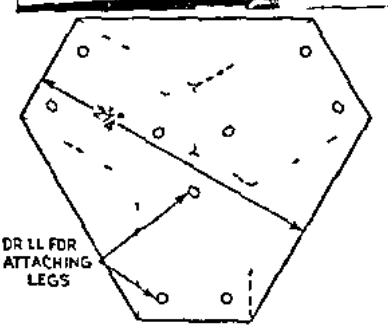


THE gleaming polish of this hand-hammered copper fruit bowl contrasts effectively with its black copper stand

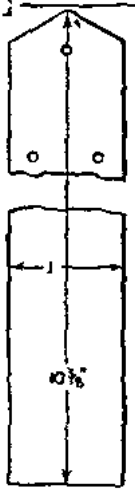
The bowl is made from an 8" diameter disk of 16 gauge soft sheet copper It is raised to a depth of 1¾ and since hammering expands the metal considerably, it still measures about 8 in diameter when finished Best results in raising the bowl can be obtained by holding it on the anvil at an angle, as illustrated below When the bowl has been completed, clean the copper with commercial nitric acid and polish it well Care should be exercised not to allow the acid to contact hands or clothing

The stand is of 14-gauge copper The parts are hammered, bent to shape, drilled, and riveted together Coat the surface with liquid copper nitrate and heat until black Dust off, then repeat Finally, polish with floor wax —DICK HUTCHINSON

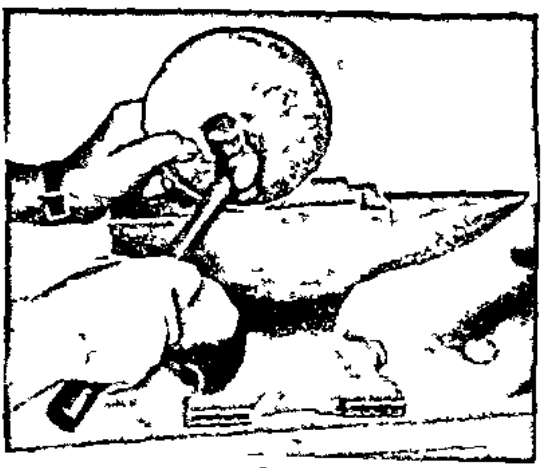
CLOCKED PROJECT
Average Time 3¾ hours



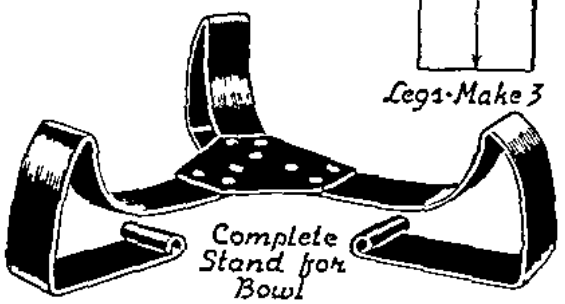
Center Plate for Stand



Legs-Make 3

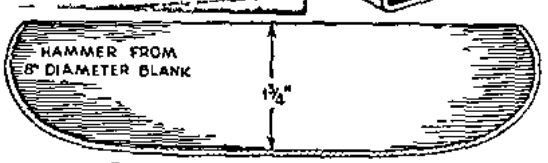


The bowl is shaped by holding it at an angle on the anvil and hammering in concentric circles



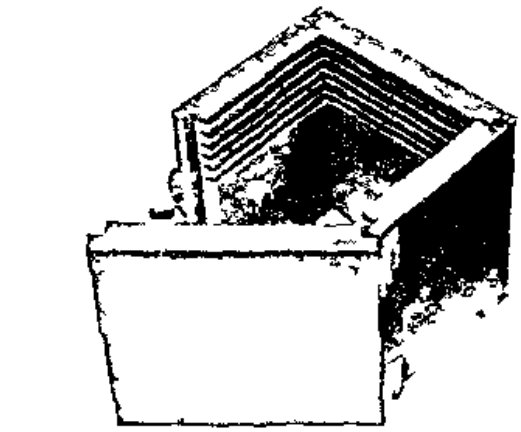
Complete Stand for Bowl

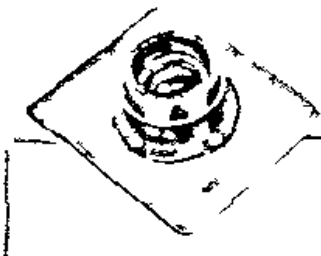
The stand consists of three legs and a connecting piece These are riveted as in the upper photo then coated with liquid copper nitrate and heated to blacken the metal



Cross Section of Bowl







Parts of the attachment as made for use with the enlarger at left

By
ALFRED P. LANE

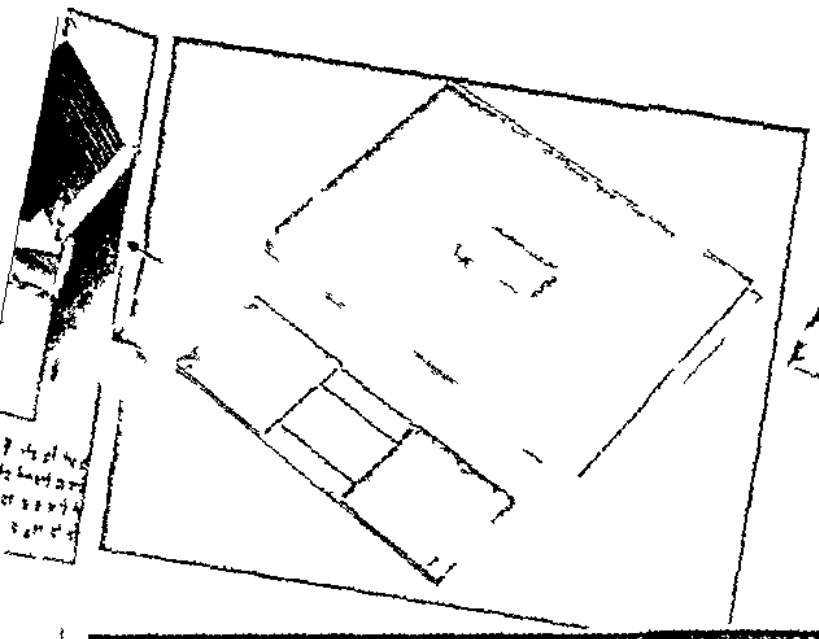
DUST and Newton's rings cause more grief to the miniature camera enthusiast who does his own enlarging than all other difficulties put together. Particles of dust seem to take a fiendish delight in getting on the negative; yet the more pains you take to get the negative and the contacting glass surfaces spotlessly clean, the greater the chance of trouble with colored rings caused by light interference or Newton's rings. These show up in the enlargement in the form of mysterious blotches.

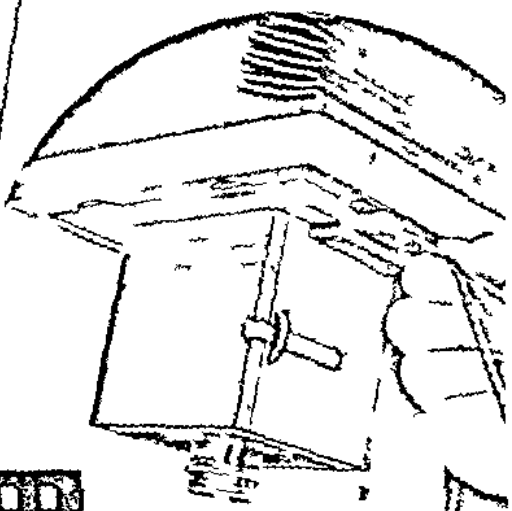
Both troubles can be avoided by using a miniature enlarging unit like the one shown. This was designed to work with any standard size enlarger, but the same method of handling film can be applied to many types of strictly miniature enlargers.

The parts consist of a duplicate of the lens board of the enlarger, a film track which is screwed to it, and a lens housing that holds the lens and provides a means of coarse adjustment for the focusing.

The film track requires two strips of wood (sawed in one long piece of course and then cut apart) with the face side sawed as shown to provide a groove or rabbet for the edge of the film. The tracks are screwed to two rectangular pieces. Velvet is cemented to these pieces at both ends, and smaller rectangular pieces of thin brass shim stock are located under the uncemented center portion of each pad. The brass pieces should have just enough spring to push the velvet against the emulsion surface with a very gentle pressure. In use these velvet pads remove every speck of dust as the film is pushed through, and the absence of glass prevents any trouble with Newton's rings.

The sides and door of the lens box are cut from a long board after the grooves have been dadoed or sawn into it. This insures that the slots will match at the corners





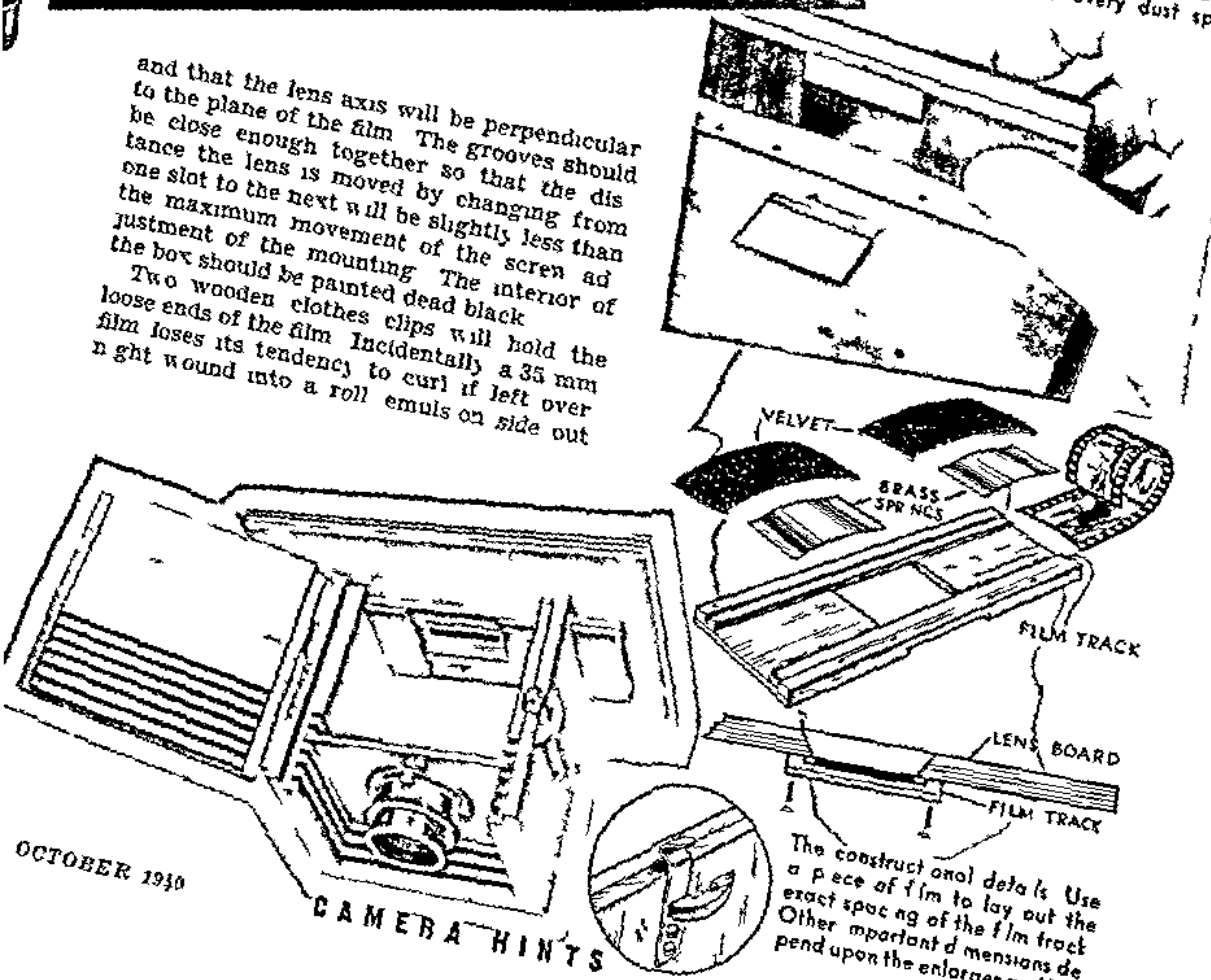
Attachment

AND NEWTON'S RINGS

The film is pulled through a track fitted with velvet pads that automatically remove every dust speck

and that the lens axis will be perpendicular to the plane of the film The grooves should be close enough together so that the distance the lens is moved by changing from one slot to the next will be slightly less than the maximum movement of the screw adjustment of the mounting The interior of the box should be painted dead black

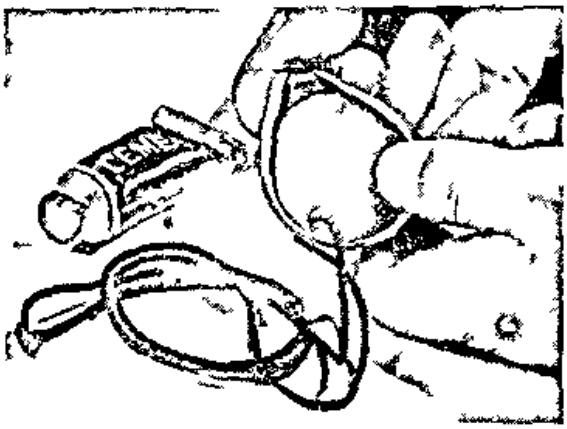
Two wooden clothes clips will hold the loose ends of the film Incidentally a 35 mm film loses its tendency to curl if left overnight wound into a roll emulsion side out



The construction details Use a piece of film to lay out the exact spacing of the film track Other important dimensions depend upon the enlarger and lens

Rubber Band Guards Edge of Visual Filter

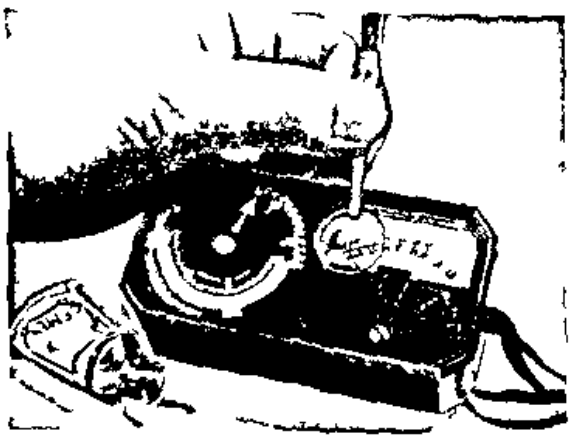
IF YOU carry a visual filter of the colored or monotone type for any length of time the edge is likely to become ch pped from knocking against hard objects As a pre ventive sl p a fairly w de short rubber band around the filter and cement it in place with *shellac or rubber cement* —C L



The edge s kept f om ch pp ng by a rubber band

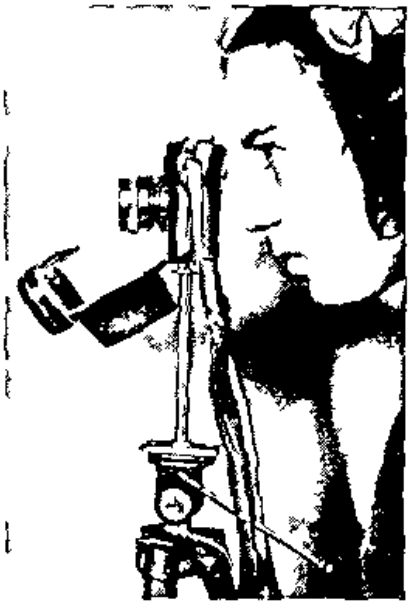
Lens Aids in Reading Meter in Dim Light

WHEN you use a photo electric exposure meter to judge dim light the pointer rests in a crowded reg on of the scale where it is difficult to take an accurate reading The dial can be read much more easily by ob ta ning a small plano convex lens from an old camera view finder or other optical in strument and attaching it directly to the dial cover glass with cellulose cement or Canada balsam The lens should not be so thick that it projects beyond the outside sur face of the meter case —EDWARD BURNHAM



A small d scarded lens is cemented to the cover glass of the d al to magn fy the crowded d v s ons





Tripod Extension Lets Camera Stay in Case

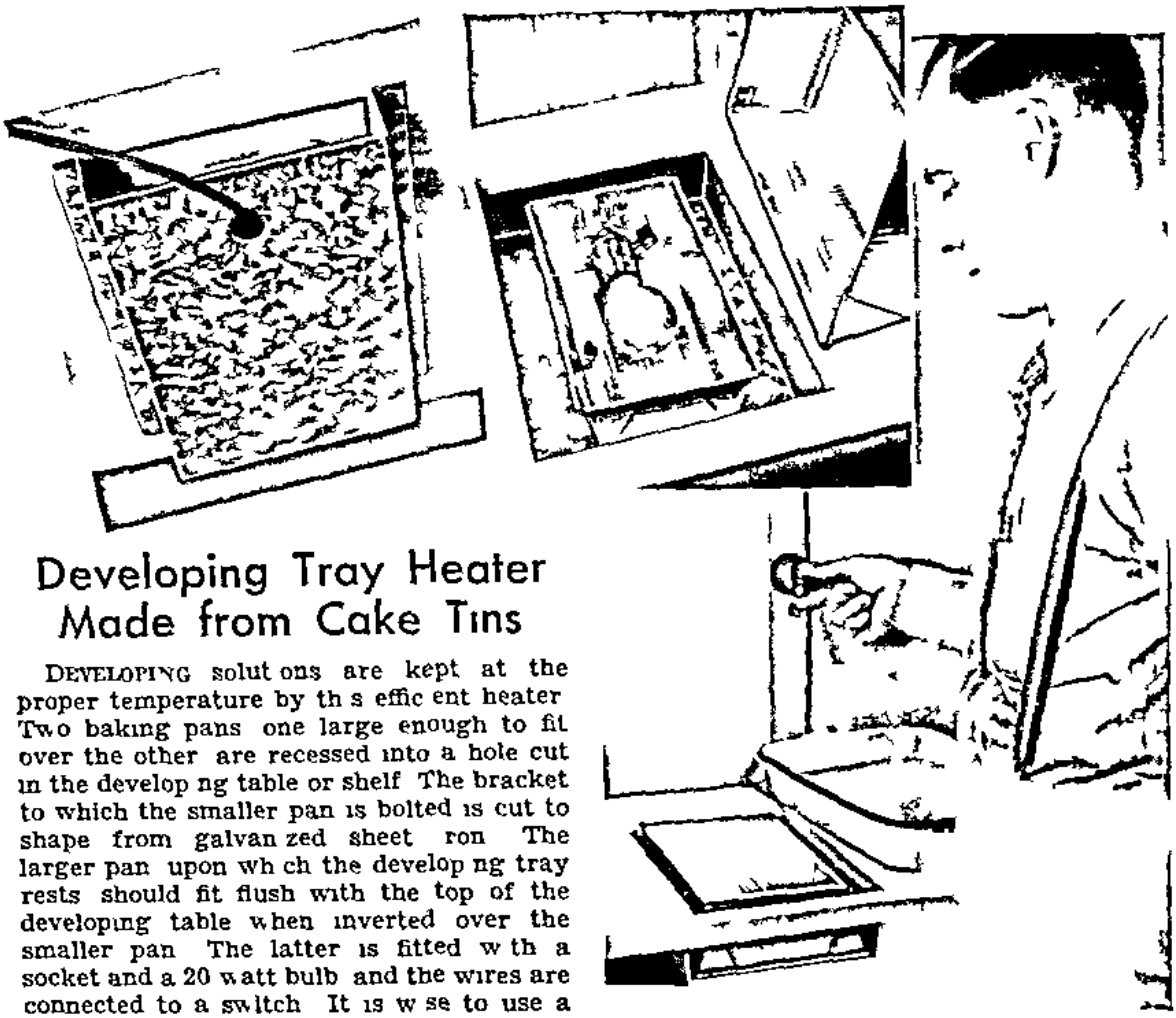
OUTDOORS it is preferable to keep a min iature camera protected by the case even when a tripod is used This is usually pre vented however by the short distance from the tilt top to the tripod head as a result of which the leather flap cannot drop low *enough to clear the lens*

The simplest remedy is to make a tripod extension as shown from a piece of ¾" round brass rod 4" or 5" long Turn down one end to ¼ or to suit the depth of the tripod socket in the case Thread this end ¼" 20 to match the socket threads The oth er end is drilled to a depth depending upon the length of the tilt top thread then tapped ¼" 20 If desired flanges may be turned as shown so that the diameter of the extension *is* reduced to ⅝ —NATHAN SPERBER

How to Remove Bubbles in Tank



MORE than ordinary agi tation is often required to dislodge small air bubbles from a roll film after the tank is first filled with developer The bubbles are best jarred free by insert ing a nickeled but tonhook into the tank and lifting the reel up and down sharply three or four times as necessary —OLIVER BANDELIER



Developing Tray Heater Made from Cake Tins

DEVELOPING solut ons are kept at the proper temperature by th s effic ent heater Two baking pans one large enough to fit over the other are recessed into a hole cut in the develop ng table or shelf The bracket to which the smaller pan is bolted is cut to shape from galvan zed sheet ron The larger pan upon wh ch the develop ng tray rests should fit flush with the top of the developing table when inverted over the smaller pan The latter is fitted w th a socket and a 20 watt bulb and the wires are connected to a switch It is w se to use a red bulb so that if the pan should be lifted inadvertently no photograph c paper will be damaged—E B W

Sunk flu h w th the top of the wo ktable or shelf the heate cons sts of two cake t ns nclos ng a 20 watt bulb Upper left the support ng bracket

RETOUCHING PRINTS, PART 2 [PHOTOGRAPHY]

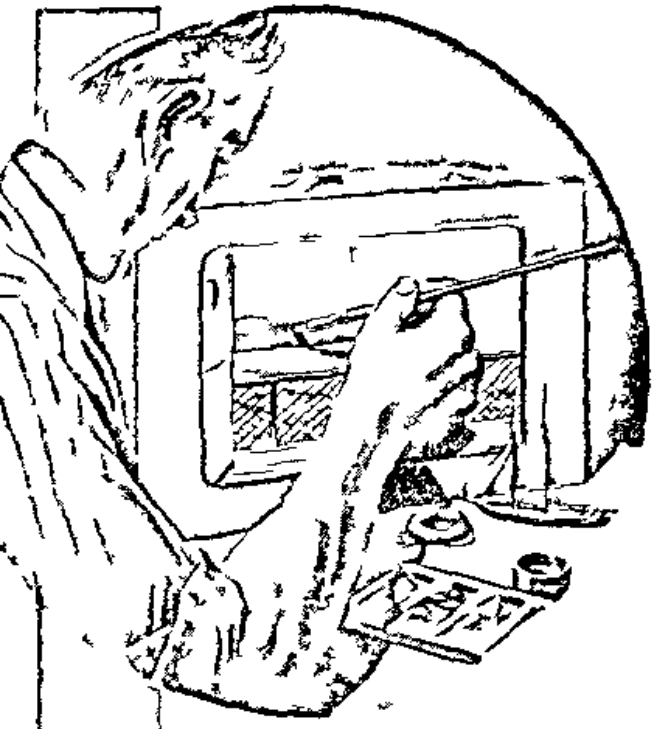
Water Color Small cards coated with black white and sepia are available at photo supply shops and offer a convenient source of water colors for spotting prints Use a spotting brush and dot the color on do not attempt to paint the area For work on glossy or ferrotyped prints add a little mucilage to the water and experiment until the gloss of the color when dry matches that of the print

Dry Spotting Special carbon and photo positive retouching pencils are quite satisfactory and may be obtained in several shades Ordinary lead pencils leave too much sheen on most emulsions but they may be used on some if the spotting is carefully rubbed in with the finger tip

Glossy Prints These are difficult to work on without leaving evidence of the retouching Some workers claim however that coating the sur face with negative retouching medium spotting with a pencil then re soaking and ferrotyping will give excellent results

POPULAR SC ENCE MONTHLY SHOP DATA FILE

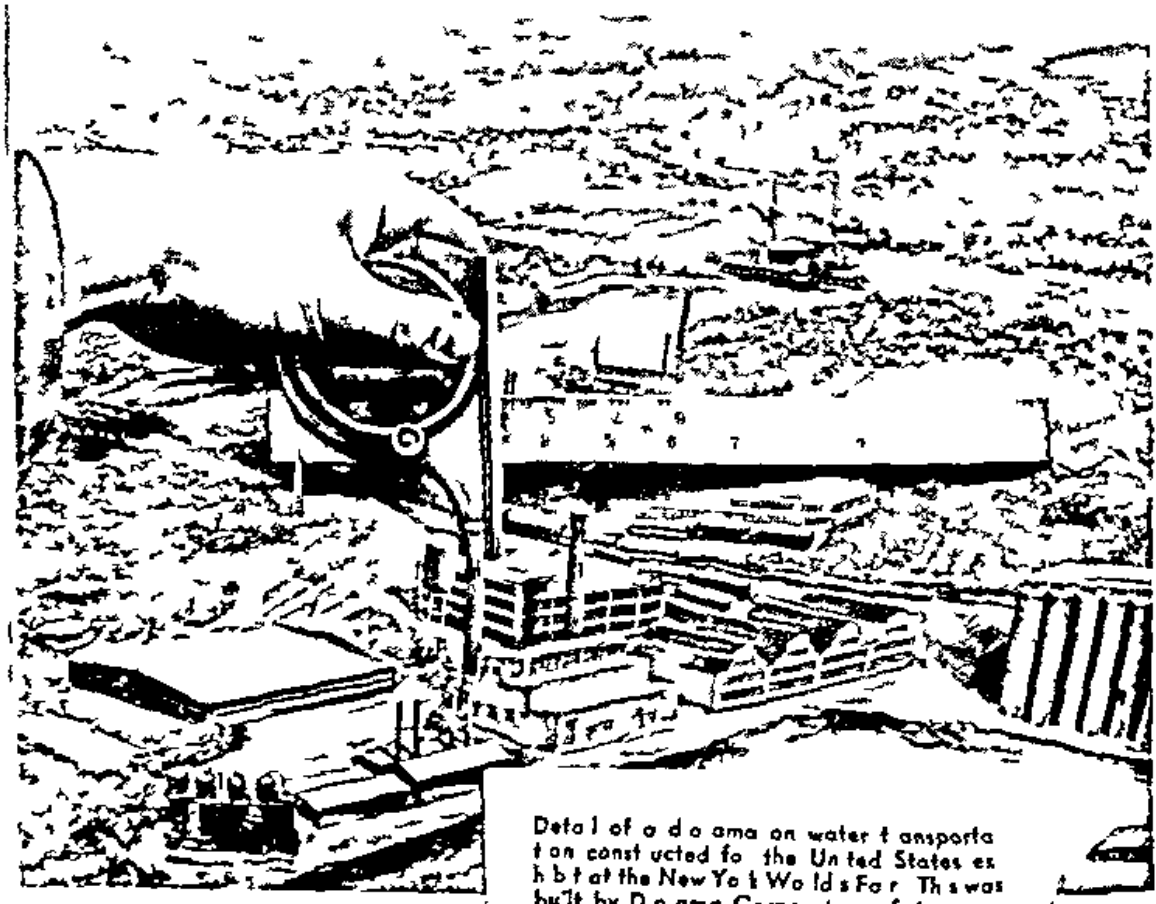
SCENES



D o amas rep esent ng nea by scenes and close ups a e bu lt n a box w th s des top and bottom that slant n wa d as shown on the oppos te page

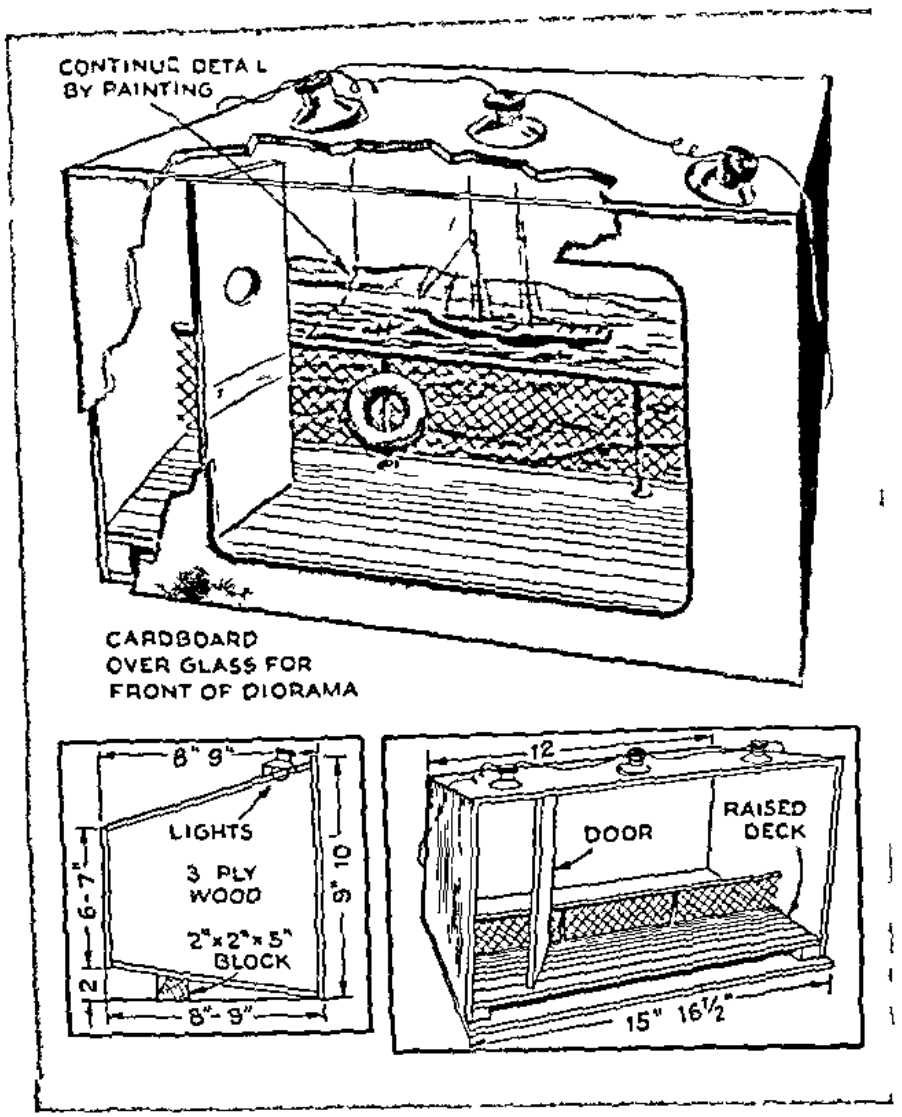
IF YOU were able to visit the New York World s Fair you must have been impressed by the lavish use throughout the entire exhibition of large and small dioramas or miniature scenes In almost every build ng these have been used to portray outstand ng events methods of manufacture his toric places and all kinds of informa tion in vivid colorful three dimens onal form

Whether it was an old fashioned stagecoach stopping before an inn a modern Coast Guard vessel on patrol a blast furnace in operation a series of historical views like the Forward March of America or something as huge as the City of Light and Rail roads in Action these scenes were startling in their reality They were illuminated by hidden lights and some even showed the same scene under various l ghting effects such as dawn



Deta l of a d o ama on water t ansporta t on const ucted fo the Un ted States ex h b t at the New Yo k Wo ld s Fa r Th s was bu lt by D o ama Corporat on of Ame ca

IN MINIATURE



Hints on constructing small dioramas for home decorations, window displays, and advertising or educational purposes

By HERBERT LOZIER

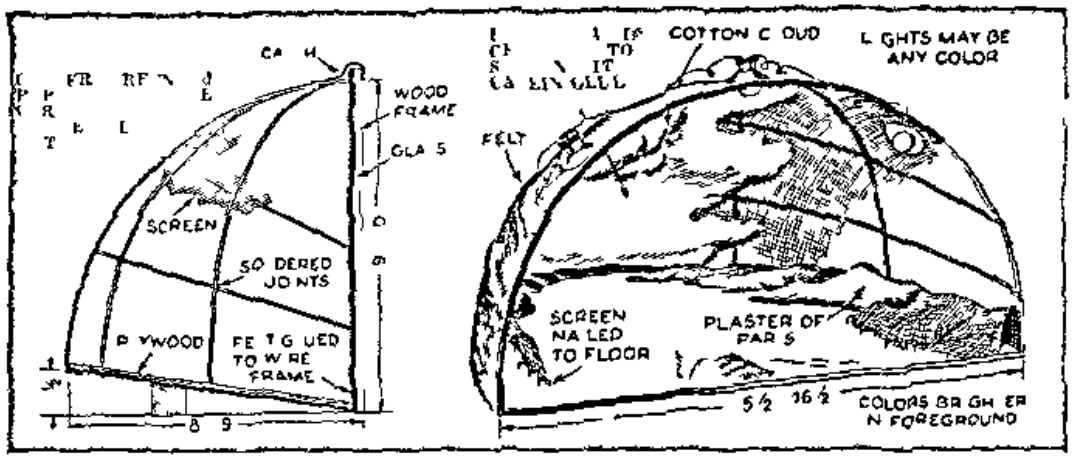
to dawn—all so beautifully done that you felt you were looking at a Lilliputian world

These dioramas imitate life far better than any picture because there is depth to them Their natural power to attract attention has made them extremely popular for window displays and advertising and as permanent exhibits in museums schools and libraries

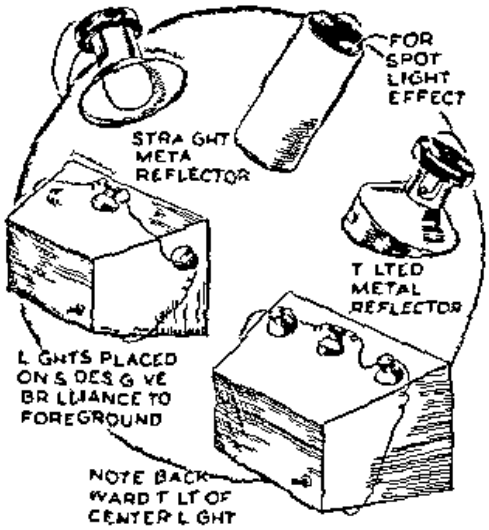
As you looked at them, you may have wondered whether you could build similar models on a small scale as ornaments or for advertising or educational purposes You can By using the methods shown in the accompanying illustrations you will find it comparatively easy to duplicate scenes like those just mentioned or others of your own choosing Bear in mind however that the sketches and measurements are examples chosen to show the general principles of the art and are not intended to be copied in their entirety for any one diorama Details vary in each case

You will notice that there are two kinds of dioramas one with a square or flat background and the other with a curved background The latter is used when the effect of distance or a far horizon is required The former is more appropriate for objects closer at hand.

After you have decided upon the subject of your first diorama—and it is suggested that you make the first one rather simple—begin with a baseboard or floor It can be



Four stages in construct ng a d orama with a curved background Th s type

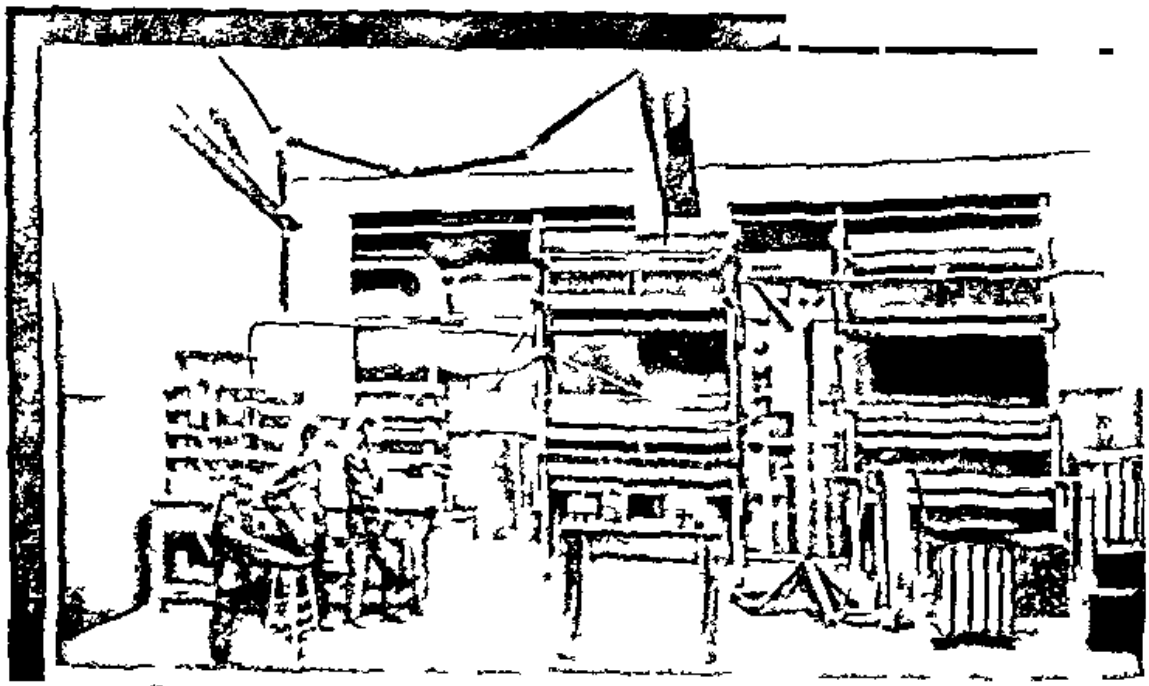


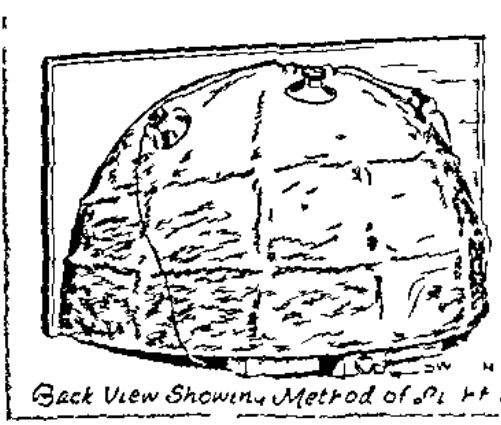
of thin three ply wood Cut it to shape square or semicircular as requ red by the subject you have chosen If it is semicircular drill the holes for the wire frame In e ther case a p ece of wood must be beveled off and placed beneath the base as shown to give the desired incl ne

Next the background is put on the baseboard It is either plywood for the square type or wire screen and *papier mâché* for the spherical type Be careful to leave enough space for the frame of glass and wood. When this work has been completed you may start to place the scenery and subjects ins de

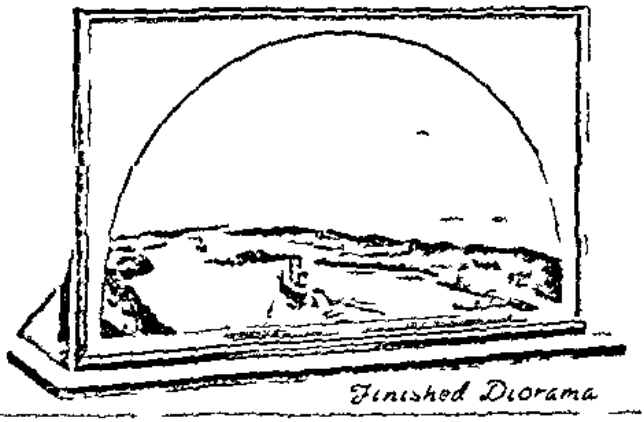
It must be remembered that all the subjects mak ing up the scene should appear to have depth A feeling of distance must be obtained The objects in the foreground are always larger than those in the background and the colors closest to the eye are

Cha es P Ste nmetz n h s Labo ato y 14 w de 7 deep 8 h gh Also by D orama Corpo at on





Back View Showing Method of Lighting



Finished Diorama

is used for outdoor scenes in which great distance or a far horizon must be shown

always the brightest All subjects must be cut so they slope toward the rear to give the correct perspective

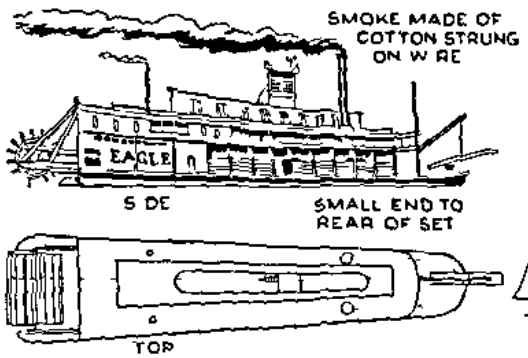
A few of the materials you can use are illustrated but many other odds and ends will come in useful Model airplane cement is suitable for all gluing purposes

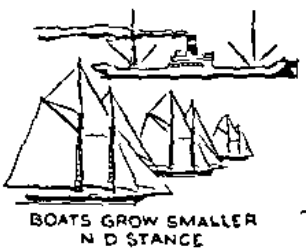
Ordinary plate glass together with card board wood dowels or strips of wood form an excellent frame for the finished diorama It is a good idea to place a length of felt between the glass and the set to prevent dust from getting in The frame may be glued and nailed directly to the base and the top may be left open to allow the glass front to be removed Provide a secure fastening at the top

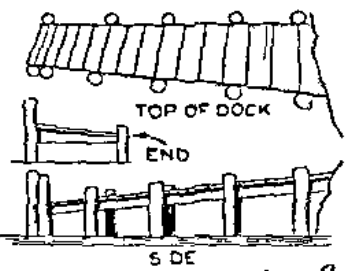
The lighting is easily arranged Ordinary Christmas tree or radio pilot light sockets may be used Avoid however pointed Christmas tree bulbs which are likely to show below the frame Various colored lights will give different effects and indicate the time of the day It is even possible with the use of a small motor and a suitable rheostat to have the lighting change automatically

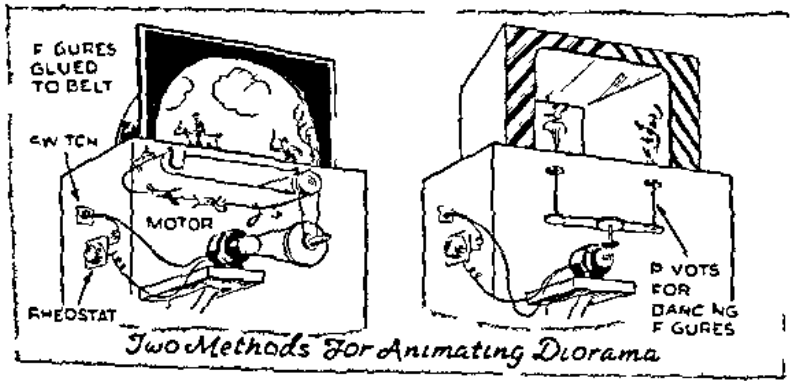
Reflectors should be used with all lamps The center lights should be tilted backward for best results and the other lights set at any angle you wish

Two methods of making the subjects move are also suggested in the drawings but these too should be attempted only after considerable experience has been acquired in constructing dioramas

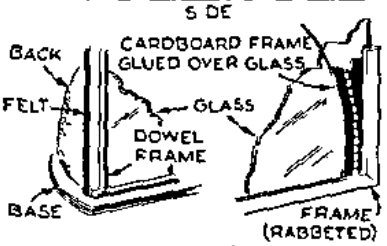








Two Methods For Animating Diorama



Frames For Dioramas

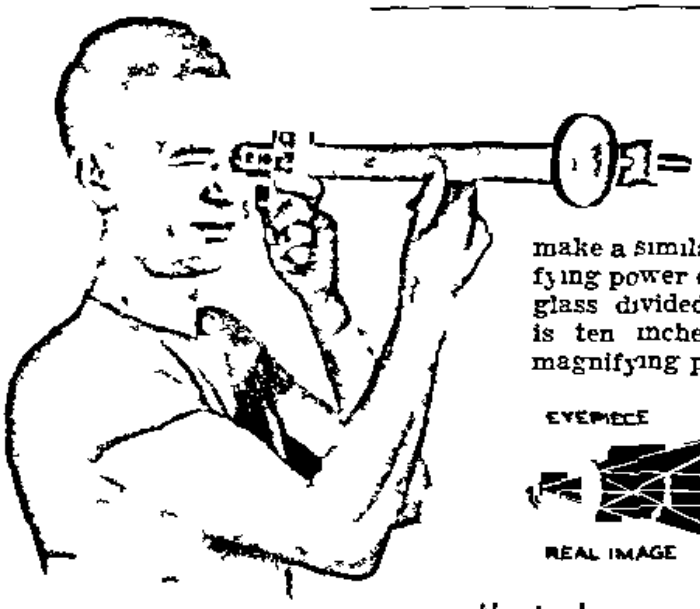
SIZE OF OBJECTS AND INTENSITY OF COLORS DECREASE WITH THE DISTANCE FROM THE EYE

HOME-LABORATORY

SUCH simple apparatus as a reading glass, a concave shaving mirror, a short focus magnifier known as a linen counter and a fragment of a pocket mirror, enables a home experimenter to demonstrate optical principles of telescopes microscopes cameras projectors and magnifying glasses

To locate the important principal focus' of any lens or mirror, hold a white card at the right distance—called the 'focal length" —to form an image of a distant object.

Convex lenses and concave mirrors, alike, can be made to produce either 'real" or "virtual images. A real image can be caught on a screen like the ground glass of a camera. Virtual images are what you see through a magnifying glass, in a shaving mirror, or through the eyepieces of most telescopes and microscopes.



IN A refracting astronomical telescope, a long-focus lens produces an inverted real image and a short-focus lens is used like a magnifying glass to inspect the image Your reading glass and short focus magnifier, suitably mounted as at left, will make a similar experimental telescope Its magnifying power equals the focal length of the reading glass divided by that of the eyepiece If the first is ten inches and the second, one inch, the magnifying power will be ten times



How two lenses are combined to form an experimental telescope

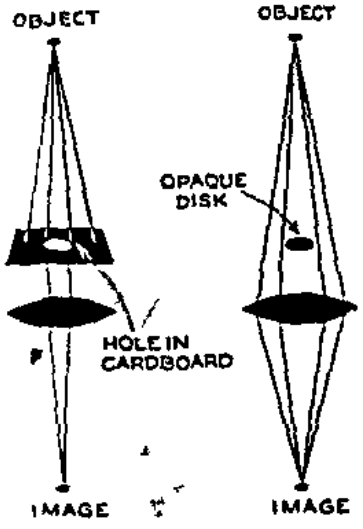
WITH the same two lenses that you used in the telescope described above, you can construct a compound microscope This time however, the lens of shorter focal length serves as the objective, or lens nearest the object to be viewed By placing this lens above the object at a distance just beyond its principal focal length, a greatly magnified real image is obtained The eyepiece is brought a little nearer than its focal length to this image, giving a virtual image enlarged still further Note that, as with the telescope the virtual image is the apparent but not the real source of light rays reaching the eye The accompanying drawing shows how the lenses are placed and paths of light rays.

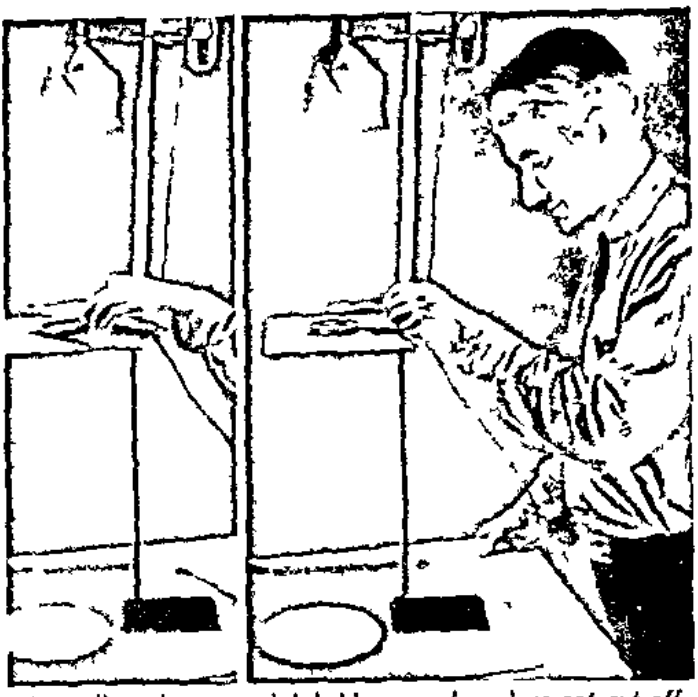




By reversing positions of the lenses, you get a working model of a compound microscope

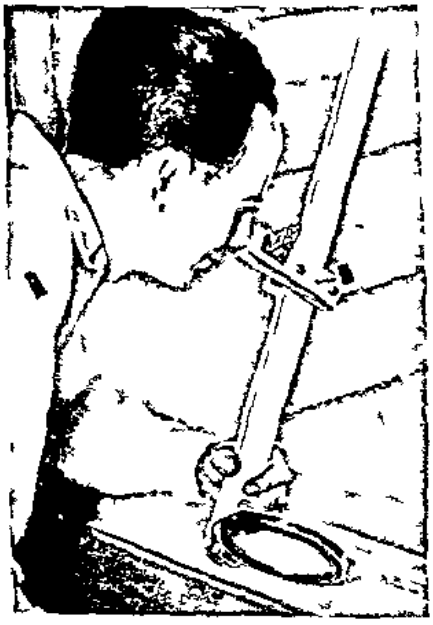
TESTS WITH LIGHT





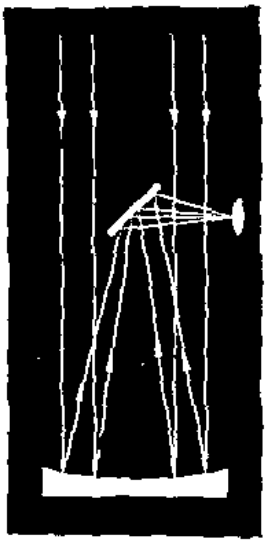
A cardboard ring or disk held over a lens does not cut off any of the image but merely dims it Drawings explain why

WHY isn t a circular shadow thrown on a picture when you stop down or narrow the aperture of a camera lens? With the illustrated set-up, try covering a lens with a piece of cardboard in which a smaller hole is cut The image is merely dimmed Now try covering only the center of the lens with an opaque disk The result will be the same Rays of light entering every part of the lens go to every part of the image, and either the central or outer rays may be brought to a focus by themselves although they usually overlap An example below shows an interesting application of this principle in astronomical telescopes



Model of a reflecting astronomical telescope using a concave shaving mirror small flat mirror, and lens

REFLECTING telescopes of great astronomical observatories often have a secondary mirror interposed between the big concave mirror and the sky The smaller mirror directs the image to an observer's eyepiece, outside the telescope Why it doesn t obstruct the central part of the image has just been explained by the previous experiment To make a model telescope of this kind, arrange a concave mirror, a small flat mirror, and a short focus magnifying glass as illustrated For viewing distant objects, the eyepiece should be near the principal focus of the shaving mirror The eyepiece acts as a magnifying glass giving an enlarged virtual image of the image produced by the mirror Any distortion of the image will be due largely to the imperfect surface of the mirror Ordinary concave mirrors are ground to a circular, rather than a parabolic curve



DEVELOPMENTS IN



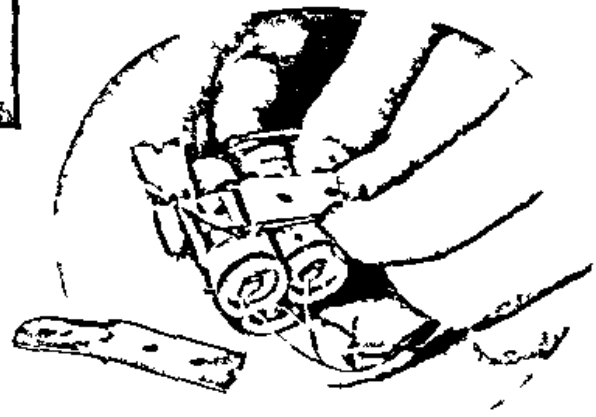
A close up of the new elect c eye phonog aph n use

Phonograph Pick-Up Uses Electric Eye

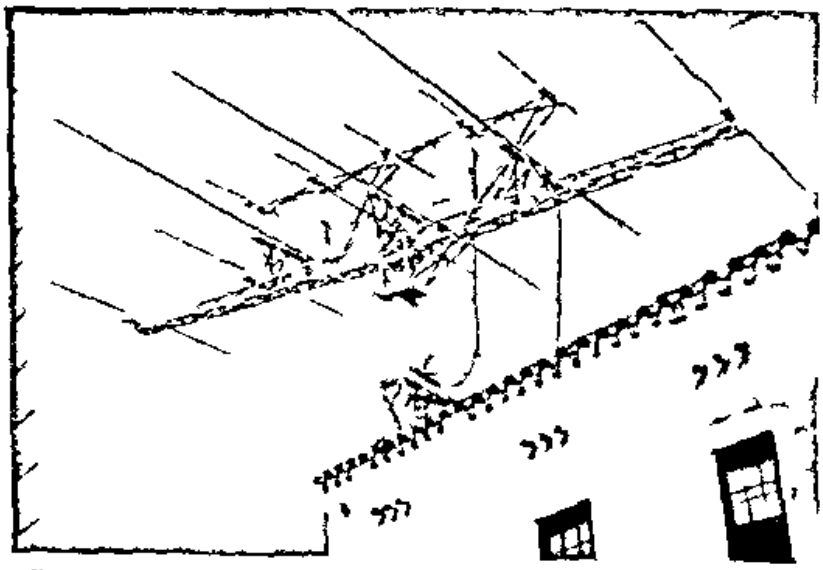
BETTER reproduction of phonograph records is claimed for a pick up recent ly introduced by a nationally known radio manufacturer On the pick up arm a tiny rounded jewel replaces the conventional needle to follow the record groove Attached to the jewel is a small mirror which vibrates with the jewel and in turn reflects a beam of light against an electric eye The eye or photo electric cell then translates the vibrations of the light beam into elec tric impulses in the amplifying c rcuit to reproduce the music or other sound of the recording

Strap Binds Condensers

VARIOUS combinat ons of small size tubu lar electrolyt c condensers can be combined into a single installation unit for easy mounting with the handy metal straps shown in the illustration at the right Flex ible and soft enough to be cut with scissors the straps are locked with a metal eyelet



How the st ap b nds seve al condensers into one un t



Th ee rooftop antennas n a s ngle assembly that we ghs only 187 pounds

Amateur Builds Triple Antenna for Transmitter

THE novel three layer composite transmitter antenna atop the home of W4EDD a Coral Ga bles Fla amateur weighs only 187 pounds The top section is a five element quarter wave affair for 56 megacycles The bottom is a similar type for 28 megacycles while in the center is a three element closed spaced array for 14 meg acycles

THE RADIO WORLD

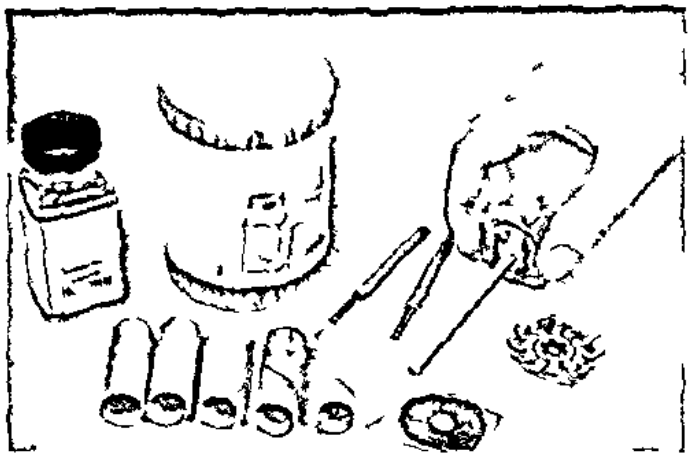


Radio Chemical Kit Aids Repair Men

CONTAINING eight bottles of different chemicals useful to the radio service man the compact kit shown in the illustration above is a valuable accessory on repair jobs Cement polish oiling compounds carbon remover and similar products are among the materials

Inexpensive Switch-coil Outfit

REMARKABLY inexpensive an outfit with which amateurs can make their own five coil single switch units to replace plug in tuning coils is now available Coil forms spacers the various switch parts and a bottle of special lacquer cement are included in the kit Additional switch wafers and coil forms are furnished by the manufacturers at moderate cost



With these parts it is easy to build a compact switch coil set

Coat-Pocket Portable Set

FOUR tubes are used in the circuit of a tiny new battery powered loudspeaker radio just announced As shown in the illustration at the right the midget set is so small that it is readily carried in a side pocket of a man s suit coat.



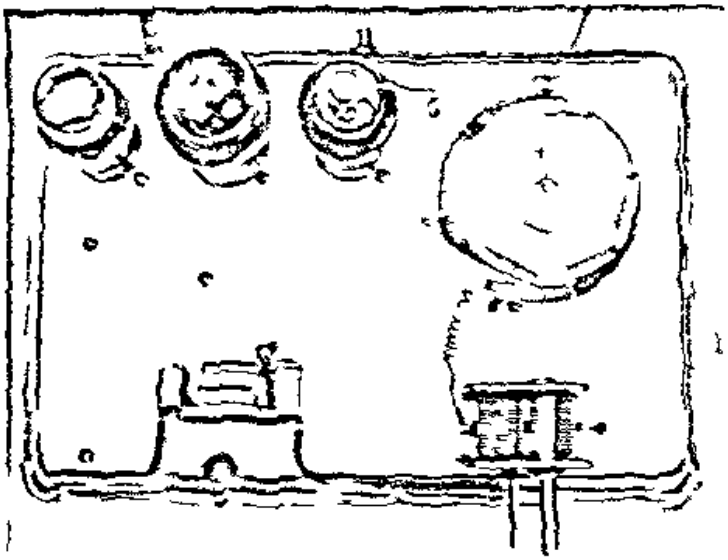
The tiny set fits in a pocket Batteries run it for 100 hours without replacement

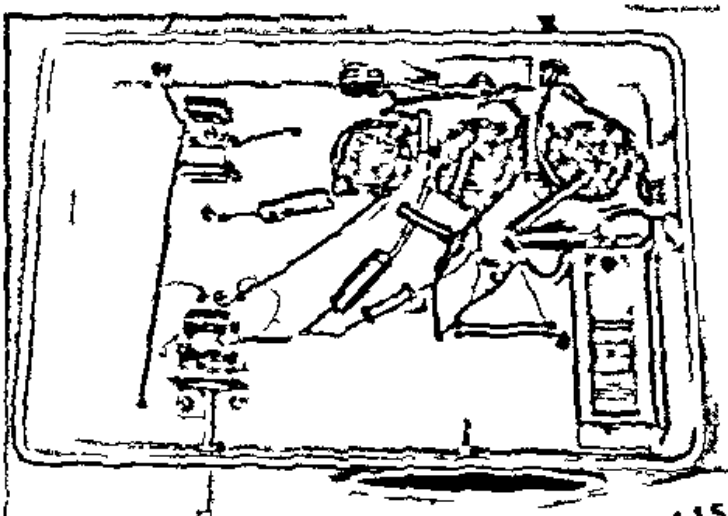
Midget Current Inverter



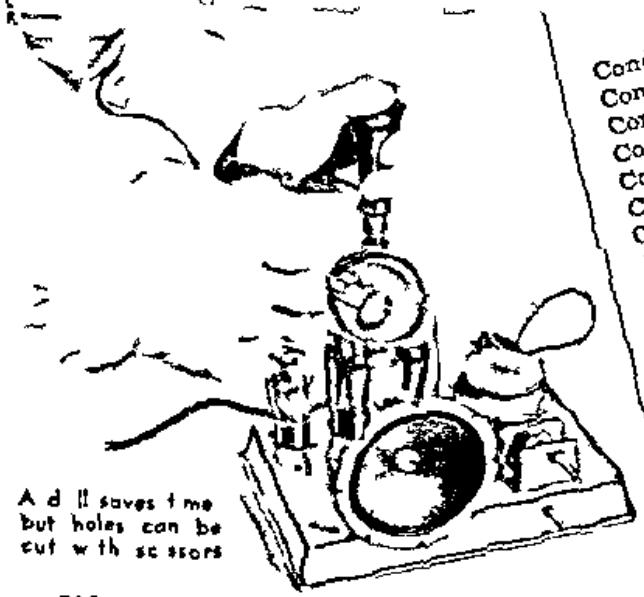
SMALL enough to fit inside many electric phonograph cabinets the compact inverter unit shown at the left makes it possible to run alternating current phonograph motors where only direct current is available The unit is simply plugged into a DC house outlet and the phonograph cord is plugged into a socket on the case

Four Dollars Builds





Top and bottom views of the receiver showing the placement of the parts on the ten cent cake-pan chassis. The regeneration control set back from the edge is mounted on a small bracket



A drill saves time but holes can be cut with scissors

WHEN I finished building the receiver shown, I dubbed it the "Economy Three" for it had cost me only $4.06 not including the cost of the wood for the cabinet, which I salvaged from my workshop scrap pile. It was an easy receiver to build the hand wound coils were easy to make and the parts fitted nicely into the chassis with plenty of room to spare

The chassis I purchased for ten cents at my neighborhood five and ten. It's simply an inverted aluminum cake pan 10" long and 6¼" wide. Being made of thin aluminum sheeting it was easier to work than most chassis materials. In fact, although I used a regular chassis punch to cut the three holes for the tube sockets they could

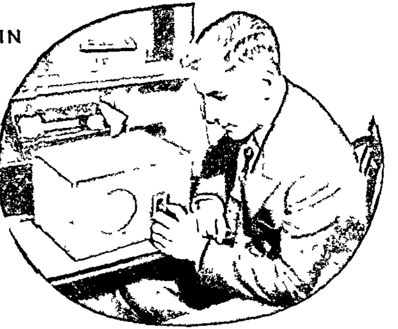
LIST OF PARTS

Condenser variable .000365 mfd.
Condenser mica, .00015 mfd.
Condenser mica, .0005 mfd.
Condenser tubular .005 mfd., 400 v.
Condensers tubular three .01 mfd., 400 v.
Condenser electrolytic, 20 mfd., 200 v.
Condenser electrolytic 5 mfd., 25 v.
Resistor carbon, 1,000 ohm 1 watt.
Resistor carbon 2,000 ohm, 1 watt.
Resistor carbon, 600 ohm ½ watt.
Resistor carbon, 300,000 ohm ½ watt.
Resistors carbon two 1 meg., ½ watt.
Regeneration control 25,000 ohm

Miscellaneous: Tubes, coil wire cake-pan chassis five-inch magnetic speaker 200 ohm line-cord resistor on-off switch, six prong wafer sockets, wire, solder etc.

This Loudspeaker Set

By FRANK TOBIN



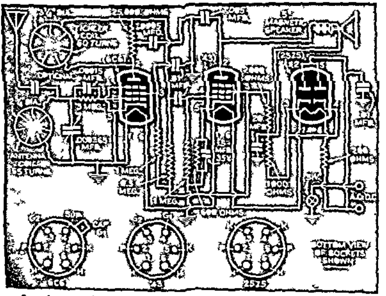
The completed outfit gives loudspeaker volume with a short antenna

have been cut with an ordinary pair of scissors Because of the pan s sloping sides, however, the 25 000 ohm regeneration control had to be mounted on a small aluminum bracket some distance behind the front edge as shown at the extreme left The same screws that hold the variable tuning con denser can be used to support the bracket

The A C D C circuit is simplicity itself It uses three tubes—a 43, a 6C6 and a 25Z5 rectifier—and provides sufficient pep to operate a loudspeaker Because magnetic speakers are generally sensitive to weak signals I chose one of that type It cost me 93c

The homemade coils are quite easy to wind Before going into the actual construction details however, there is one important point that must be remembered In making the coils, adhere strictly to the specifications such as the size of the wire, the length of the antenna attached to the antenna coil, the distance between coils, etc

First cut out two round cardboard disks, one 2¾" in diameter and another 3¼" Then divide each form into seven equal sections and cut a slot down each line about 1/16" wide to within ⅝" of the center On the smaller form wind 55 turns of No 30 double-cotton-covered magnet wire Pass the wire first over one section and then under the next—alternating as you go round When finished this will be the antenna coil The larger coil is the tickler coil and consists of 60 turns of the same wire In checking the number of turns, add the turns on two adjacent sections In other words, a coil of 55 turns will have twenty-seven windings on one 'rib' and twenty eight on the next



Specifications for the circuit and the hand wound pancake type coils

The coils are mounted on the chassis by means



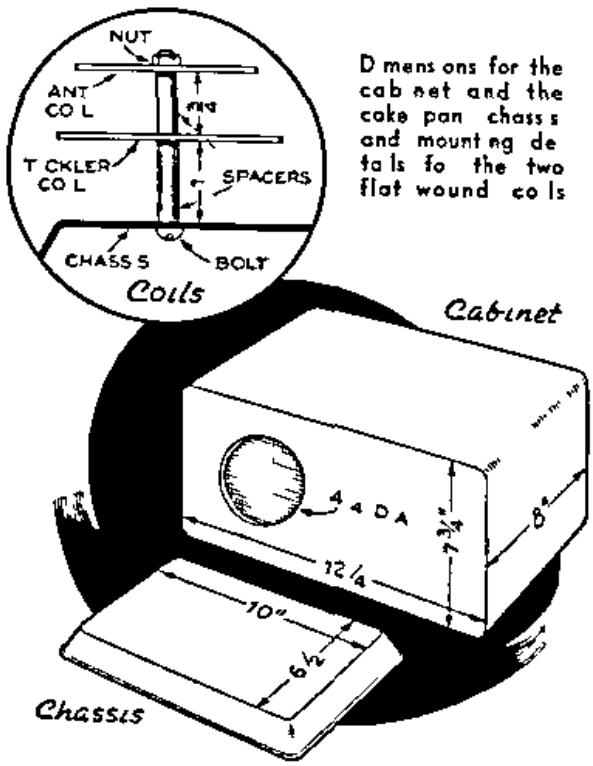
The wire goes over and under the formers

of a brass machine screw $2\frac{1}{2}$ long and two brass tubing spacers $\frac{1}{4}$ in diameter The tickler coil should be placed nearest the chassis and 1 from it The antenna coil should be placed $\frac{3}{4}$ above the tickler coil Refer to the drawing below for details

The cabinet whose dimensions also appear in the drawing below can be made of any wood that you may have in your scrap pile It has an open back and the chassis can be conveniently held in place with two screws driven into the baseboard.

A 25 antenna should be used and it can be left on the floor or hung out of a window On my version of the set I used rubber insulated stranded wire and it worked particularly well If a longer antenna is desired a 00005 mfd fixed mica condenser must be inserted in the antenna lead

By adding to or reducing the number of turns on the antenna coil the sets range can be varied to receive stations just below or just above the broadcast band



Dimensions for the cabinet and the coke pan chassis and mounting details for the two flat wound coils

More Power

LAST month as the first in a series of six articles on easily built circuits for radio experimenters a two tube all electric receiver was described This month a stage of resistance coupled audio amplification will be added to give the set more power

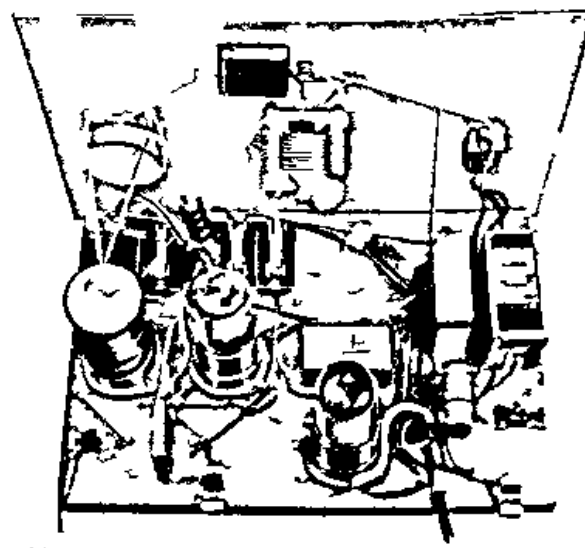
For the additional stage we will use the triode section of the 25B8GT tube used in the original design and six new items from the original list of parts. The new parts consist of a 002 mfd. mica condenser a 200 000-ohm $\frac{1}{2}$ watt resistor a 1 megohm $\frac{1}{2}$ watt resistor a Fahnestock clip for the ground connection and two fuse mounts to hold the resistors The 002 mfd. mica condenser is used for coupling the detector stage to the audio stage and is mounted on the baseboard in a vertical position In the photographs it can be seen next to the antenna clip The two $\frac{1}{2}$ watt resistors are also mounted on the baseboard next to the other resistors

In order to avoid feed back and undesirable oscillation the grid lead to the

LIST OF PARTS

(Included in last month's list)

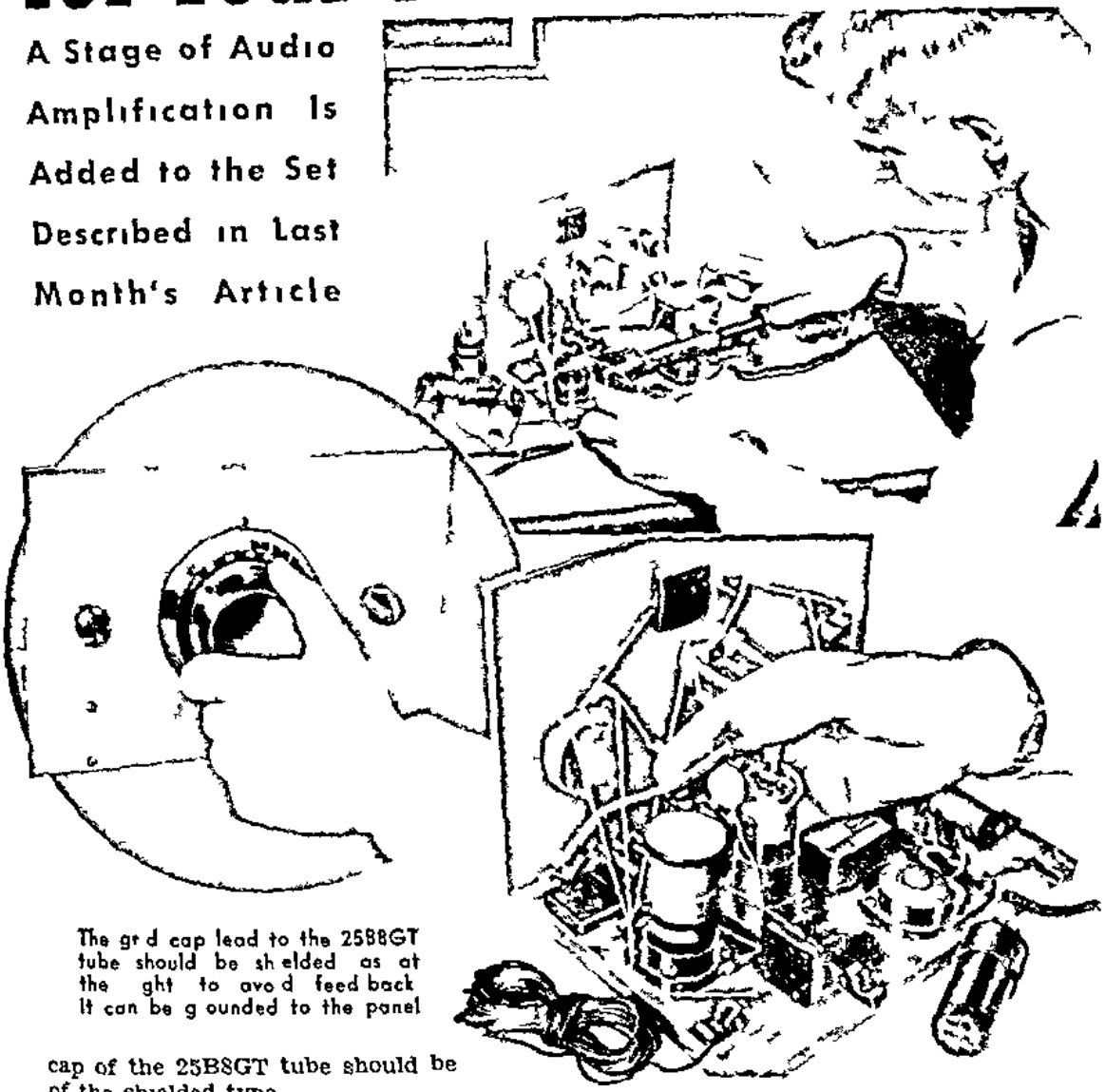
Condenser mica 002 mfd.
Resistor Carbon 200 000 ohm $\frac{1}{2}$ watt
Resistor carbon 1 meg $\frac{1}{2}$ watt.
Fahnestock clip
Two fuse mounts



How last month's two tube set should look after adding a stage of audio amplification

for Your Two-Tube Radio

A Stage of Audio Amplification Is Added to the Set Described in Last Month's Article

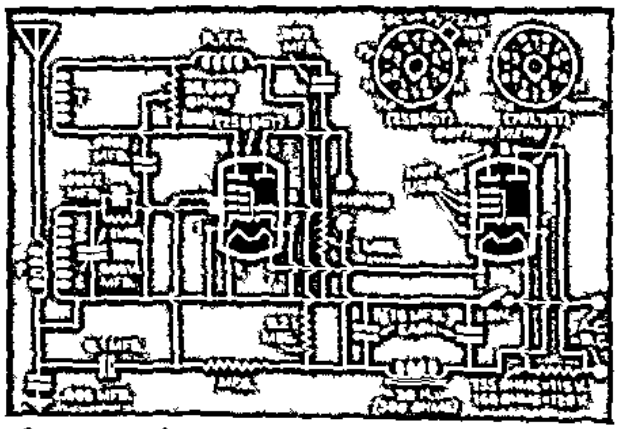


The grid cap lead to the 25B8GT tube should be shielded as at the right to avoid feed back It can be grounded to the panel

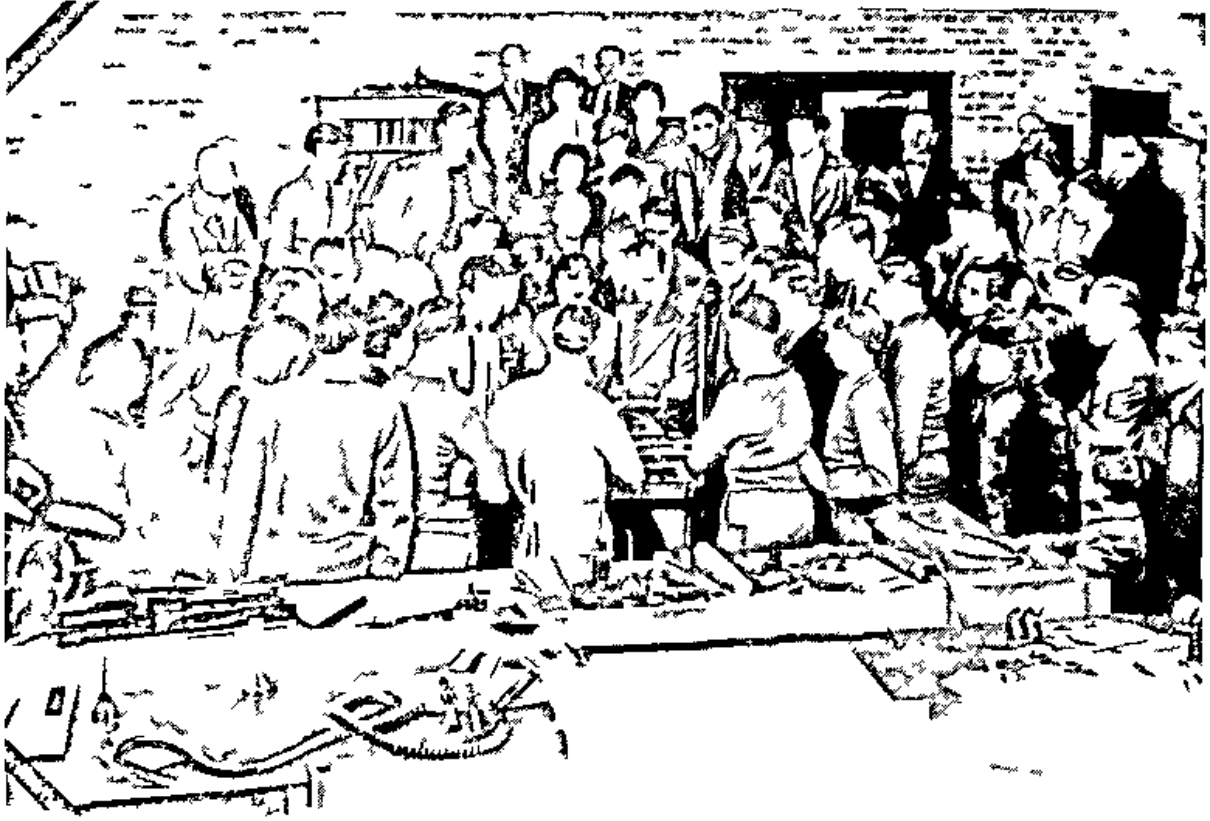
cap of the 25B8GT tube should be of the shielded type

The 006 mfd tubular condenser connected in the first design between the plate of the rectifier tube and the ground is now used for adding an outside ground connection to the set The 006 mfd condenser isolates the outside ground from the ground wiring in the set

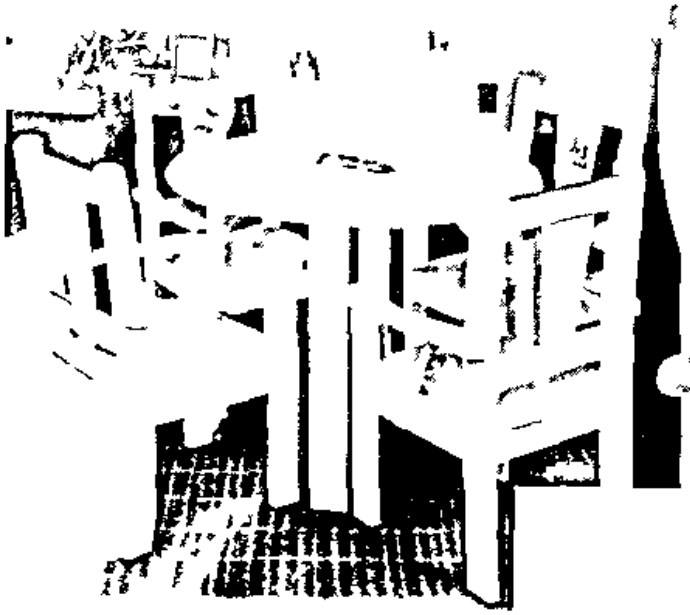
An indoor antenna 20 to 25 long is all that is needed with the audio stage If a longer antenna is desired a trimmer condenser must be inserted in the antenna lead How to build one from scrap parts will be described in the next of this series of articles



Six additional parts provide the new amplifier circuit



What Guildcrafters Are Doing



As Easy as ABC

The DELCO ELECTRO-LEVEL Prevents Over-Filling

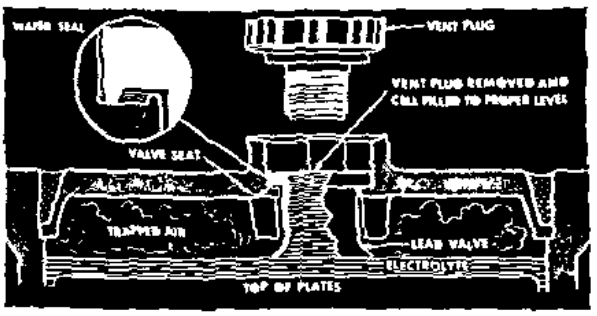


Remove the vent plug . . . and automatically the new Delco battery is protected against over-filling. Why is this protection important? When a battery is being charged, pressure is built up inside the cells by the gases which are released. These gases should pass freely through the vent holes; but when the electrolyte level is too high, acid is sprayed out. The acid corrodes the battery carrier and connections.

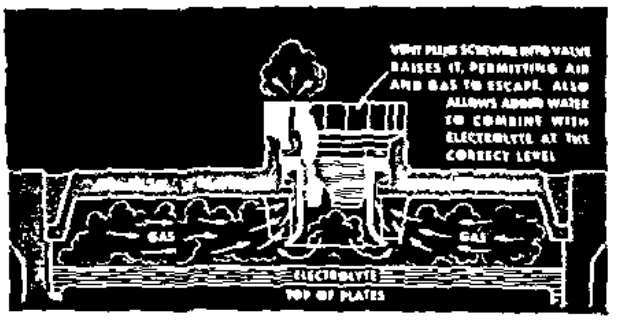
The secret of the automatic protection provided by the Delco Electro-Level is a sliding valve which drops down to form a water-sealed air lock when the proper electrolyte level is reached. When the plug is screwed in place, the valve is lifted to form an efficient baffle arrangement that breaks up acid spray and allows only gas to escape.

Delco batteries are original equipment on 43 per cent of all new cars sold. For sure starting ability and dependability, replace with a Delco battery.

HERE'S HOW THE NEW ELECTRO-LEVEL WORKS



Vent plug removed for filling—valve forms air lock when electrolyte reaches proper level. Notice particularly the *water seal* formed when the edge of the valve drops into the layer of water retained in the ridge around the valve seat. This layer of water is replenished by condensation, eliminating any possibility of a leak in the air lock when the lead valve is in position for filling.



Vent plug screwed in—valve is raised to permit escape of *trapped air* and gases from the cell through the passage and the vent hole in the plug. Notice here the efficient baffle arrangement through which the gases *must pass*. This condenses moisture and breaks up the *acid spray* which might otherwise escape to damage the battery carrier and connections to the battery.

Delco-Remy

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World's Largest Manufacturer of Automotive Electrical Equipment

4 REASONS WHY "PRESTONE" ANTI-FREEZE IS 1ST IN AMERICA

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"Prestone" anti freeze has seen more motorists safely through more winters than any other brand

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Behind "Prestone" brand anti freeze is one of the most famous guarantees in motordom It says plenty in writing

"Prestone" anti-freeze is ethylene glycol PLUS *special* processing and *exclusive* ingredients that make it America s finest anti freeze

One shot of Prestone anti freeze lasts all winter There s no replacing no boil away no fumes no foaming no fire hazard It is harmless to your cooling system pre vents rust and corrosion See your dealer today

$2.65 PER GALLON



The words Prestone and Eveready are regi tered trade marks of Nat onal Carbon Company Inc

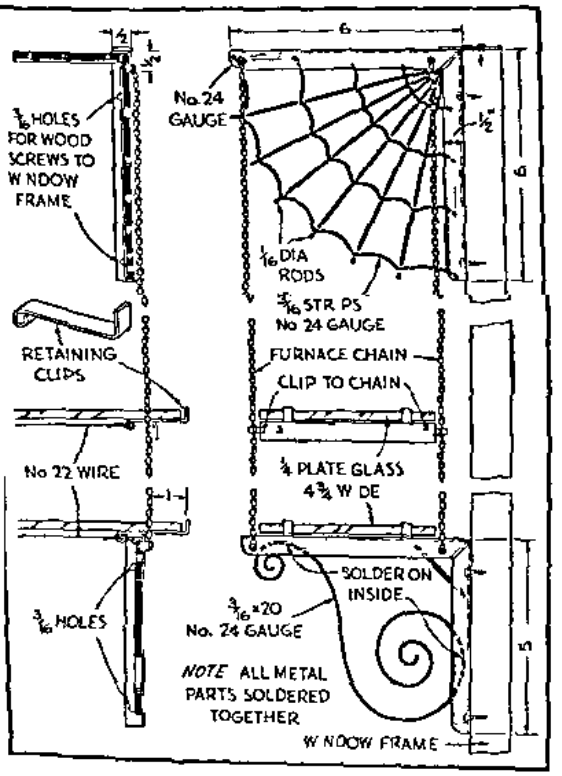
"PRESTONE" ANTI-FREEZE

"There's nothing else like it"



Window-Shelf Brackets of Spider-Web Design

PLATE GLASS hanging window shelves ave become popular and a decorative arangement can be made inexpensively as hown The supports are of 24 gauge galanized sheet iron *(Continued on page 214)*



"But, madame—I am an artiste!"



"Who, me?" said I, when this housewife asked me to polish her car for my victuals, "A retired impresario?" Whereupon she just handed me a can of polish and said, "No work, no food get busy!" Which I did, for just then I smelled steak sizzling



Imagine my joy! Why, this polish imparted a dazzling shine with scarcely more effort for me than when I wielded the baton for the Hoboken Philharmonic! "Ah, No 7," I said, examining the can . . . my favorite number!" Then I saw that it was "made by Du Pont"

"That No 7 Polish," I confided, as I topped off my steak with a slab of pie, is made by the same people who made the 'Duco' finish for my last three town cars No wonder it bestows such a lustre! And using it left me so full of vigor I'd be charmed to chop some wood for you, Madame"



DU PONT **№ 7 POLISH**

made by the makers of DUCO* and DULUX*

*Reg U S Pat Off

WANT A SAMPLE?



Du Pont Dept 6 SP, Wilmington Del.

Send me a sample of No 7 Polish—enough for hood and fenders I enclose 6¢ to help cover mailing costs

Name_____

Address_____

City & State_____

(Offer good in U S only)

CLEAN AUTO UPHOLSTERY with DU PONT "TRI CLENE," the non inflammable cleaning fluid which leaves no odor.



...and GUESSWORK leads to grief in more repairing jobs. Be safe. Get piston rings that are specifically *Engineered* for your particular model of car.

Insist on

McQUAY-NORRIS

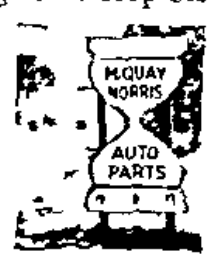
ALTINIZED

Engineered Set

PISTON RINGS



THERE s no guesswork with these rings be cause each Engineered Set is specially made for one particular make and model of car and *precision installed* accord ing to blueprint instruc tions That s why these rings will stop oil waste and prevent blow by — in *your car* And *each ring* is *Altinized*—an exclusive McQuay Norr s feature—to give long life and reduce wear

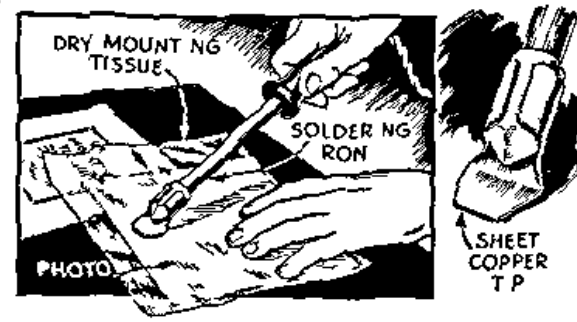


McQUAY-NORRIS MFG CO
St Lou s Mo

1" wide folded to an angle with ½" legs and 1/16" diameter iron or brass rod Com mon furnace damper chain is used to hang the ¼" plate glass shelves

The top brackets are shaped to resemble a sp der s web All four brackets are per manently screwed to the window frame As many intermediate shelves as desired may be hung d rectly on the cha ns Each shelf should have two 22 gauge steel w res run n ng lengthwise to act as a tie wire so that the shelves will not accidentally drop from under the end angles while being cleaned. Spans longer than 36 requ re heavier plate glass or else should be lightly loaded

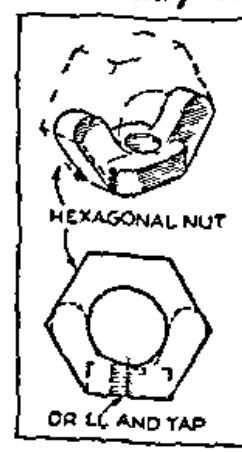
The metal may be gilded or painted flat black The gilt is pleas ng with dark window frames the black with ivory or cream frames —CARL F H SCHRADER.



Mounting Tissue Tacked with Soldering Iron

WHERE dry mounting tissue is used for sticking photographs or drawings to mounts, the tissue usually is tacked in position first so the edges can be trimmed and other operations performed without its sl pp ng The tacking is done with a warm blunt nosed tool Such a tool can be improvised qu ckly from a small soldering iron and a piece of sheet copper —W E B

Quickly Made Wing Nut



RECENTLY I needed a ¼" *wing nut but none* was on hand or could be purchased in the neigh borhood I made an ac ceptable substitute from an ordinary ½" hexag onal *nut* First I drilled a hole in one of the sides and tapped it then I cut the nut in two a little above cen ter and also cut down and filed the sides to shape —FRANK GROSS

You may worry about the plumbing



but here is one worry you can avoid

With proper care you might have avoided the worry of that leaky pipe That s true about chassis lubrication too

A haphazard job with ordinary grease means early repair bills That s why it is important to remember one word 'MARFAK,' which means our 40 point Chassis Lubrication Service We are trained in a special Texaco lubrication school We work from a special Texaco Lubrication Guide so we don t miss a point on *your* car We use Marfak lubricants They last twice as long as ordinary grease

Look for the bright red sign, Let us Marfak your car, at Texaco and other good dealers stations and leave your chassis lubrication worries with an expert

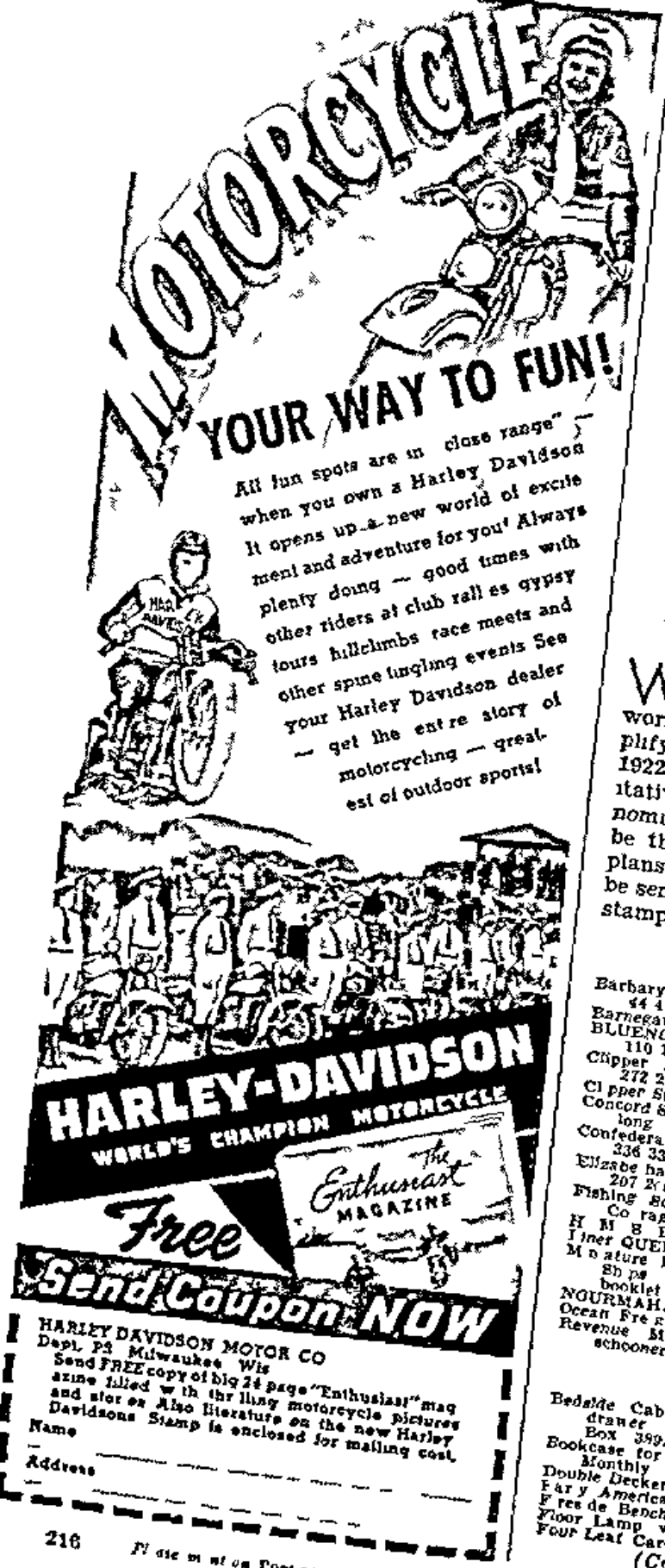
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Let us MARFAK *your car*

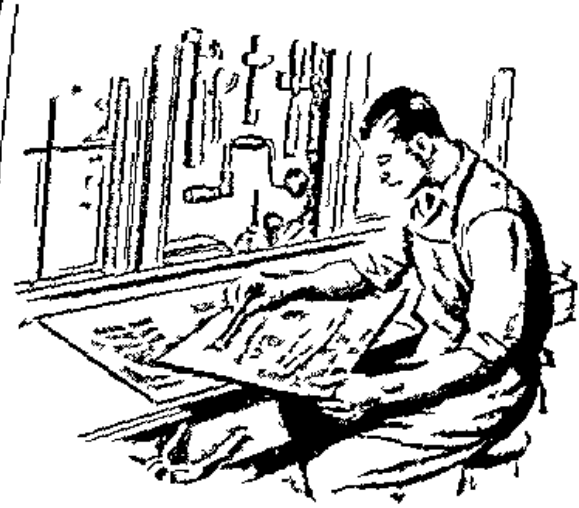
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MODELS

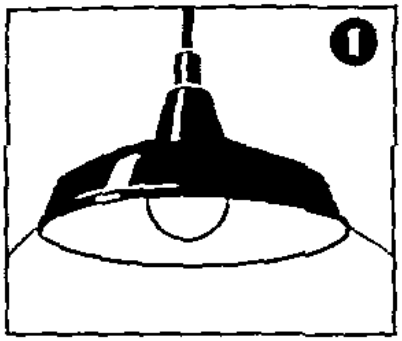
Barbary Pirate Galley or Felucca 20" long 44 45 R	
Barnegat Lighthouse 10½" high 298A	$ 75
BLUENOSE famous fishing schooner 17½" hull 110 111 112 P	25
Clipper Ship GREAT REPUBLIC 31½" hull 272 273 274 P	1 00
Clipper Ship SEA WITCH 9½" hull 219	1 25
Concord Stagecoach DIAMOND TALLY HO 20½ long 115 116 117 R	25
Confederate Raider ALABAMA 21½" hull 335 336 337 R	1 00
Elizabethan Galleon REVENGE 21" hull 206 207 208 209	1 50
Fishing Schooner WE'RE HERE of Captains Courageous 9½ over all 351 R	1 00
H M S BOUNTY 8½" hull 254	50
Liner QUEEN MARY 10¼" hull 283	25
Miniature Fleet of Nine Modern U S Fighting Ships (full size plans and instructions in booklet form 372 R	25
NOURMAHAL power yacht 8¼" hull 276	50
Ocean Freighter 14 hull 271	25
Revenue Marine Cutter JOE LANE topsail schooner 13½ hull 374	25
	75

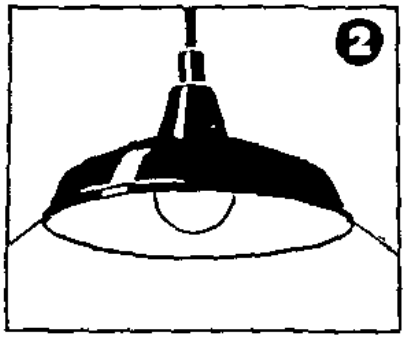
FURNITURE

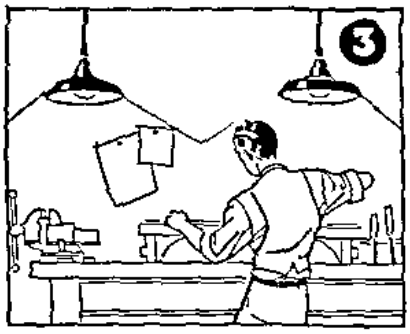
Bedside Cabinet with automatic light in top drawer also Fireplace Screen and Trinket Box 399A	25
Bookcase for Holding Copies of Popular Science Monthly 353A	25
Double Decker Bed 277A	25
Early American Round Top Stand 191A	25
Free de Bench Colonial 187A 188A	50
Floor Lamp with tripod base 243A	50
Four Leaf Card or Occasional Table 239A	25

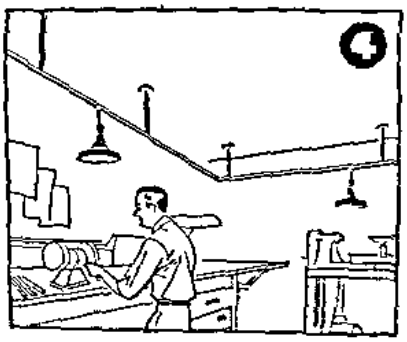
(Continued on page 218)

GOOD LIGHT
the most important tool in your Home Workshop









TRY THESE TIPS
to get more out of it

1. In a small home workshop you need at least two 150 watt G E MAZDA lamps in RLM reflectors Be sure to mount un ts *over front edge* of bench, not halfway from front to back, you ll see pencil marks better

2 For better light, put a 150-watt Sil vered Bowl G E MAZDA lamp in each reflector The mirror silvered reflector built into this bulb gives you gener ous diffused light for easier see ng

3 In a larger shop you need more of *these units To have even lighting* along the work bench the d stance between units should not be more than one and one half times the dis tance from un t to bench

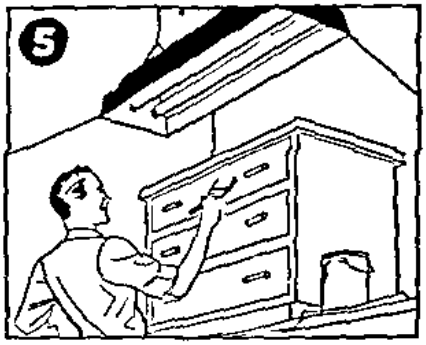
4 For flexibility some workers like this *trolley lighting system Lighting* units glide on a live but protected channel commercially available to br ng you light where you want it.

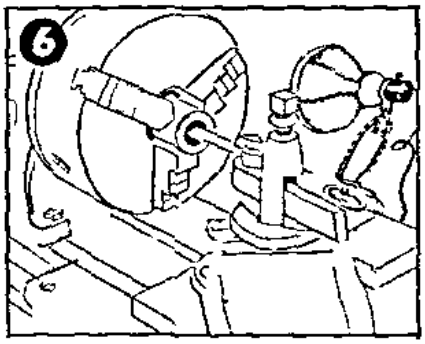
5. Need "daylight"? for painting or other color discrimination? Look *into fluorescent lighting with the* new G E MAZDA F Daylight lamps It s cool pleasing and abun dant in daylight quality

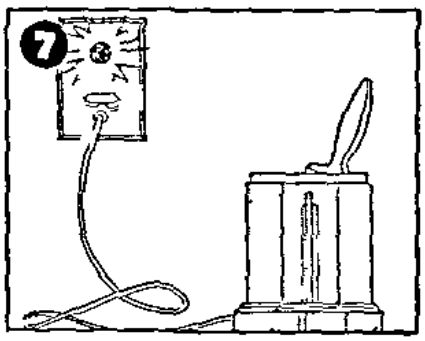
6. Horizontal boring and many another job in workshop or home becomes easier with a handy utility light like this a G E MAZDA Reflector lamp in clamp on socket that helps you put light wherever you need it.

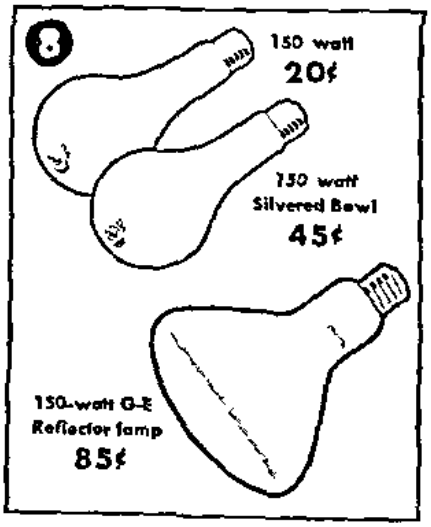
7. Avoid trouble save steps and time Use G E MAZDA lamps (10c) to indicate live circuits warning that your glue pot is on telling you upstairs that basement and bench light are on

8 Be sure that the lamp bulbs you use for your home workshop and *all* over your house are G E MAZDA lamps the kind that are *made to stay brighter longer*









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Plans for the Workshop

(Continued from page 216)

Hang ng Wall Cabinet 9½" by 24" by 41½" 250A 25
Magazine Rack ladder back style 250A 25
Silverware Chest on Stand 256A 25
Smoking Stand modern 238A 25
Tea Wagon w th removable tray and drop leaves 20 by 30" top (turning) 13 25
Upholstered Stool 240A 25

BOATS

Cabin Cruiser 17 long for use with outboard or inboard drives 356 357 358 359 R. 1 50
Camper s Utility Boat 11 2" long canvas-covered for outboard motor or rowing 281 R 50
Canoe 16 can as covered kayak can be used with sail 192 193 194 R 1 00
Can as Covered Duck Boat 13 6" long 279 R 50
Family Runabout 13 5 ½" long weighs 275 lb for outboards from 1 to 60 h p. can also be rowed 3 8 379-380 R 1 50
Fisherman s Outboard Boat 9 3 or 11 6" long weighs 115 or 160 lb for motors from 3 to 16 h p can also be rowed 344 345-R 75
Inboard Boat 15 long for motors from ½ to 5 h p can also be rowed 384 385 R. 75
Lapstreak Skiff 13 9" long weighs 225 lb for 1 to 16 h p outboard motors 363 R. 50
Midget Boat or Pram 9 long weighs 75 lb for oars sail or outboard motor 339 R 50
Motorboat Rowboat, 13 long decked hull for use with outboard or inboard drives 147 R 50
Same 14½ long 148-R 50
Same 16 long 149 R. 50
Plywood Dinghy 9' 7" long weighs 60 to 75 lb can be rowed sailed or used with small outboard motor 387 388 R 75
Racing Runabout 13 stepless hydroplane for outboard motor 261 262 R 75
Racing Sailboat BLACKCAT 13 4" long weighs 250 lb Marconi rigged 321 322 323 R. 1 00
Sailboat 12 long weighs 200 lb has fast skimming-dish hull 314 R 50
Sectional Rowboat 9 8" long two sections weighs 60 lb all wood construction can be used with small outboard motor 340-341R. 75

MISCELLANEOUS

Aluminum Trimmed Cheese Tray Letter Opener and How to Make Concrete House Numbers 390A 25
Baby s Crib and Play Pen 26 25
Birds and Animals jig saw patterns 56 25
Colonial Design Doll s House 72 25
Doll s House Furniture 73 25
Giant Repulsion Col Photographic Press and Hammered Aluminum Crumb Tray and Scraper 376A 25
Microscope Kit portable 220 25
Photo Range Finder Sailboat Door Stop and Woodpecker Door Knocker 369A 25
Projector for Photos and Pictures 259A 25

LEAFLETS AND BOOKLETS

Hints on Cutting and Drilling Glass 15
Home Workshop Index for 1938 10
Home Workshop Index for 1939 10
How to Build and Operate an Inexpensive Arc Welder and Spot Welder 50
How to Make Your Own Marionettes 50
Inexpensive Photo Equipment You Can Make Yourself 50
Workbenches and Tool Cabinets (leaflet) 10

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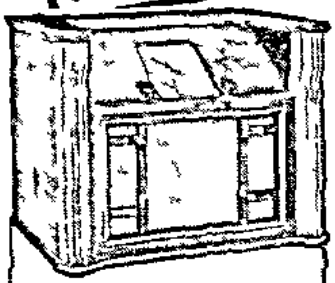
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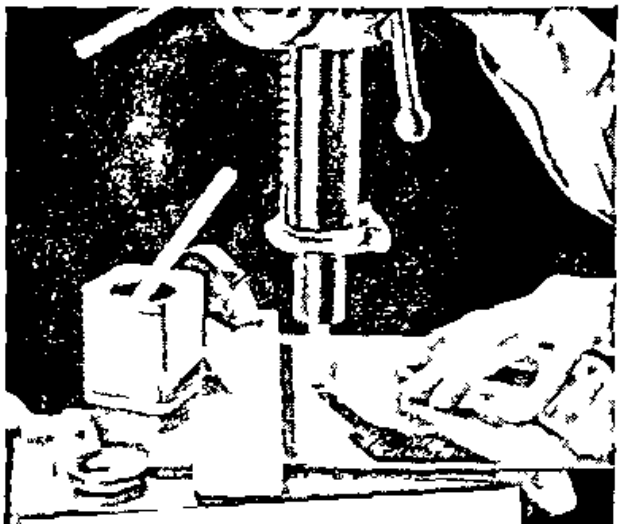
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Ask your hardware dealer or m ll supply house to show you the complete l ne of Carborundum made coated abrasives sharpen ng stones grind ng wheels and o her abras ve products for the home c aftsman. Send 10¢ co n or stamps for souven r sharpen ng stone and valuable illustrated manual on how abras ve prod ucts can save t me and help you do bet er wo k.

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Copper Keeps Tree Roots from Entering Drains

TO STOP tree roots from entering vitreous (clay) sewer tile mix 1 lb genuine copper bronzing powder to 100 lb of the dry mortar mix used in laying the pipes As soon as the mortar cracks through settling or other in jury the embedded copper becomes exposed and quickly acquires a coating of basic cop per acetate Although this is insoluble it is deadly poison to tree roots coming in contact with it and prevents further growth.

Copper powder sprinkled over the so called hot dog type of asphaltum packing has the same effect in stopping the entrance of tree roots into the joint

Where trouble with tree roots is antici pated with sewers already laid without this type of protection three parts flour and one part of copper may be mixed thoroughly with water to a thin creamy consistency then diluted to four or five times its volume with water and poured down the sewer A small amount will adhere to the greasy sides of the tile and poison any tree roots growing into the pipe The roots when poisoned will rot away—W EDWARDS BROWN

Powdered Rosin Helps Hold Turned Work in Chuck

ROSIN crushed to a fine powder forms a good binder when necessary between turned work such as wooden bowls trays or boxes which have to be finished by the so called chucking method and the hollowed wood en chuck In this process the chuck or face plate form is a piece of scrap wood turned down on the lathe until it makes a tight fit with the already turned part of the work The rosin is dusted on the form and on the turned part of the work and the two are fitted together tightly The unfinished part of the work is then ready to be turned with out danger of slipping—J R. H.

Old Phonograph Record Serves as a Sanding Disk

I HAVE found an old phonograph record makes an excellent disk sander when used on a circular saw mandrel The record should be fairly thick cheap thin records are use less for the purpose First cut the record the same diameter as the circular saw and en large the small center hole to fit the saw mandrel Cement a sheet of sandpaper to each side and trim to shape A sheet of No O paper on one side and No 1 on the other side is a good combination Ordinary rubber cement gives satisfactory results for fasten ing the paper—EMERSON W BALL.

Here's the perfect 10" BAND SAW for your Workshop

Inside Secrets of Delta Quality

"PRE-LOADING BALL BEARINGS"

Delta ball bearings are pre loaded to make Delta machines more accurate in operation Here s what this means to the prospective purchaser of power tools

In the design and manufacture of ball bearings it is practically impossible to remove all of the play or clearance In other words a perfectly close fit between the ball bearings and the races in which they run cannot be obtained This play is not visible to the naked eye It can only be measured by means of accurate instruments.

Yet, this extremely small variation will keep the bearing from running absolutely true In a drillpress it will cause a fine drill to wobble from side to side In a shaper it will make the knives rise and fall producing an uneven cut

Pre loading ball bearings as practiced by Delta eliminates all of this.

The method used in holding the bearing in all Delta tools puts a definite amount of pressure on the bearing races so that the ball bearings ride against both of the races all of the time.

Neither the inner race or the outer race can shift out of place—they are always in the same position This means that it is impossible for the bearing or the shaft which revolves in it to run out of true Thus you always have uniform accuracy in Delta machines.

If you want the best in power tools be sure that the bearings are pre loaded" Have the salesman demonstrate it to you and prove to you without a doubt that the ball bearings are pre loaded

Pre loading is another superior exclusive feature of Delta tools—a feature not visible to the naked eye—a feature too often passed over lightly yet one which is of vital importance to you.



● The massive design, advanced engineering, thoroughly studied design and accurate construction of this machine make it the finest 10" band saw ever offered to the craftsman Its capacity under the guide makes it the equal of many machines of larger throat capacity It has an exceptionally rugged heavy frame, double-sealed ball bearings lubricated for life, heavy cast iron 11' x 11 table, micrometer adjustments in upper and lower guides and many other features Some of its specifications include Overall Dimensions 33½' high, 11¾" wide 23' front to back Capacity 10" blade to upper arm 6' under guide Accurate true-running balanced wheels, carried on self sealed New Departure ball bearings—lubricated at factory for their entire life Heavy accurately ground main shaft Micrometer adjustment upper guide Each adjustment independent of others and each made with precision Micrometer lower guide, with adjustments brought out to front of table. Operator s hands never come near blade. An exclusive feature Upper wheel tilting device and tension scale similar to that used on 14' band saw Both wheels and blade thoroughly guarded, only portion of blade actually used for cutting is ever exposed For full details, prices on this and other Delta tools, fill out the coupon

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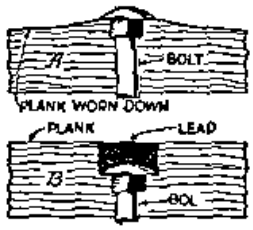
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BY THE MAKERS OF MOBILOIL

Improved Way to Fasten Floor of Stock Truck



WHEN the floor of a stock truck becomes worn the boltheads are left projecting as shown at *A*, which makes it difficult to clean the floor since the shovel continually catches on the projections A good way to avoid this difficulty is to lay the planks as at *B* with the bolts countersunk considerably below the surface and then fill the holes with molten lead This provides a floor that remains comparatively smooth because the lead being quite soft wears down with the wood —W J W

Paint Thickened with Whiting for Coating Cracked Boards

THE siding or weatherboards of an old house were cracking and many knotty places had split radially like the cuts in a pie After trying several different ways to make a presentable job of repainting the building at the lowest possible cost I finally solved the problem by adding whiting to a good grade of house paint. The paint was mixed thick enough so that it would not run out of the cracks but not too thick to adhere well to the rough surface —MAURICE GORE

Furniture Casters Need Oiling to Prevent Corrosion

IF THEY are neglected for years casters on beds and other heavy pieces of furniture may become so corroded and stiff that they will neither swivel nor roll and the floor then becomes badly marked up To avoid this take out the casters occasionally and put a little heavy oil or petrolatum on the spindle or bearings and on the pinion of the roller —H W MATTHAES.

Checking Cracks in Plate Glass

WHEN a plate glass window becomes cracked but not so badly that it has to be replaced it is desirable to take some steps to prevent the crack from extending One way to do this is to score an arc about $\frac{3}{4}$" in diameter with a glass cutter at a point $\frac{1}{4}$" or $\frac{3}{8}$" beyond the end of the crack The mark is made in such a way as partly to inclose the end of the crack but it must not touch it When the crack later extends to the arc it runs into it and is stopped

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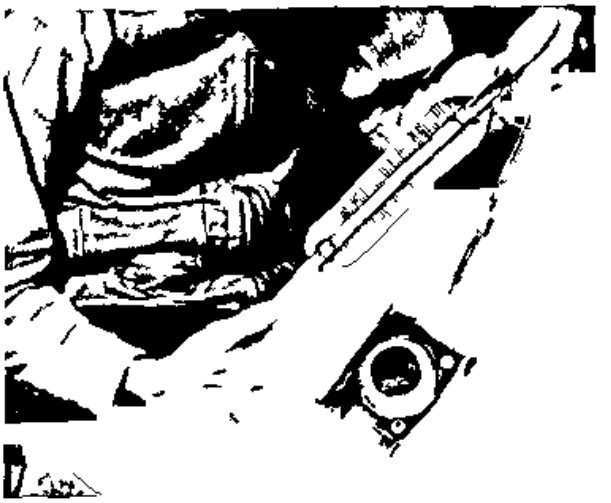
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Camera Shoulder Strap Kept from Slipping

THE shoulder strap of an ever ready camera case has a tendency to slip off To give it a positive grip on your shoulder cut a strip about 2" by 8" from a rubber stair pad or discarded inner tube Make a pair of slits at each end and thread the strap through them as illustrated —RAY KERSCHNER



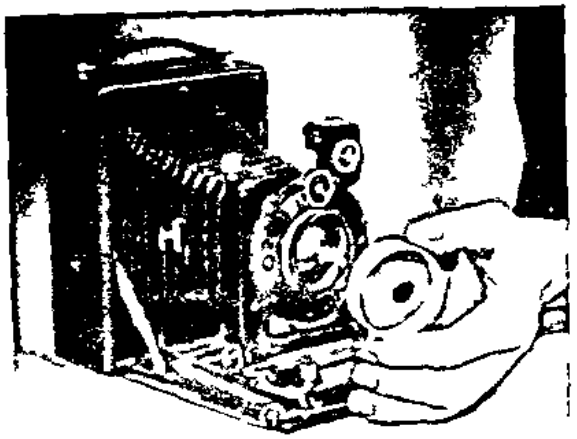
A rubber shoulder p ece s added to the strap

Brass Wire Stiffens Tube for Print Washer

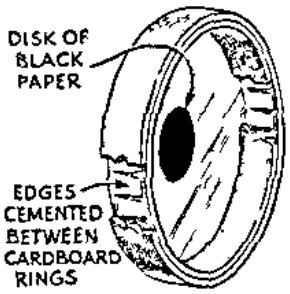
WHEN prints are washed in an ordinary tray with the aid of a rubber hose it is an improvement to insert a piece of brass or other nonrusting wire in the tubing so that it can be bent as shown below to fit around the bottom of the tray Very small holes are cut at intervals in that part of the tubing which will rest in the tray and the open end is doubled back on itself and bound with a piece of strong cord or brass wire If the holes are small enough the water will spray forcefully out of them and keep the prints agitated —FRANK CAPORAEL



The tub ng is kept in shape w th n the tray by a p ece of st ff brass or other nonrust ng w re



Lens Partly Covered to Get Soft-Focus Pictures



The spot is mounted on transparent tissue held between cardboard rings

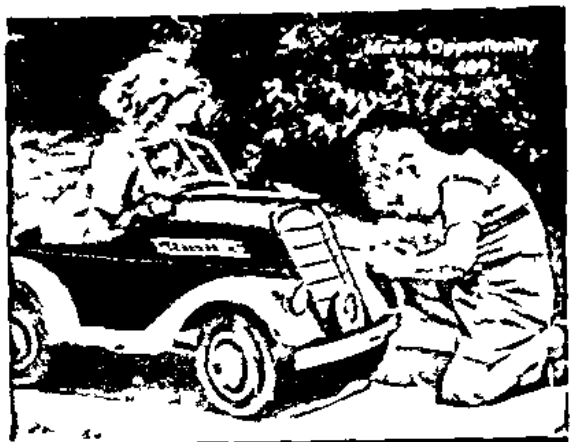
WHEN high-speed camera lenses are stopped down considerably, the image becomes sharper because the center of the lens is generally freer from optical faults than are the edges By using this principle in reverse — blocking off the center of the lens and using only the edges—beautiful soft focus effects may be obtained

A device for achieving this can be made in a few minutes Just cement a thin disk of black paper to the center of a clear, thin piece of transparent cellulose wrapping material Clamp the edges between two strips of cardboard rolled into a sort of embroidery frame just large enough to fit the lens mount. The black disk should be held as close to the lens as possible, and must, of course, be smaller than the diaphragm opening used By using disks of different sizes, various degrees of softness may be obtained. The increase in exposure necessary may be calculated by subtracting the area of the disk from the area of the camera aperture

Oars for Model Lifeboats

AN ADDED touch of realism may be given to lifeboats and dories on ship models by lashing sets of oars across the thwarts For very small models the oars may be shaped from toothpicks Lash them in place with cotton thread that has been dipped in strong tea to color it.—P. H. S

Can You BRING BACK SUMMER IN November?

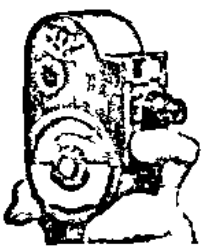


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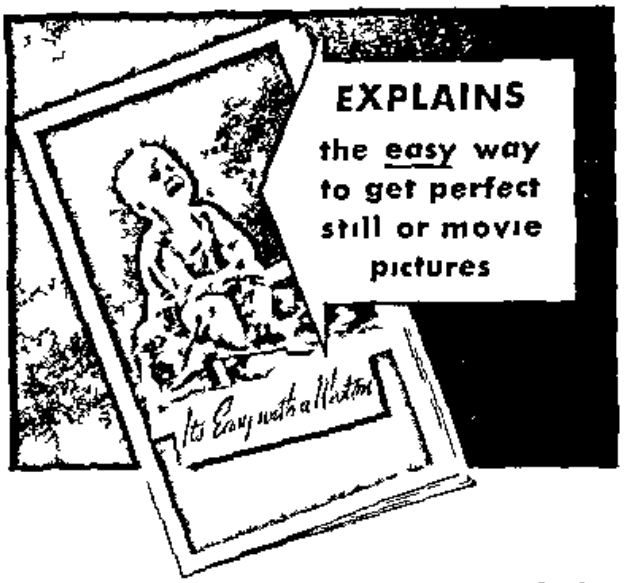
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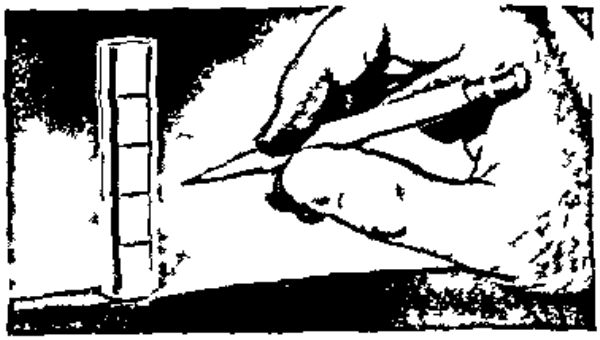


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• • •

VERY old negatives sometimes have large patches of yellow stain that cannot be re moved by any sort of bleaching process The best way out is to make a positive in the enlarger by using a G (yellow) filter on panchromatic film or plate From this positive which will be free from stain make a new negative —E B DENNISON

Spring Clothespin Keeps Prints from Clogging Drain

WHEN a drain of the type illustrated is used over the outlet of a darkroom sink for washing prints an ordinary spring wooden clothespin applied as shown to the overflow tube will keep prints from floating over and clogging the drain —SIDNEY R BAYNE



The clothesp n projects up from the s nk outlet and prevents pr nts from float ng over the dra n



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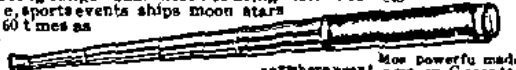
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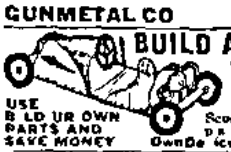
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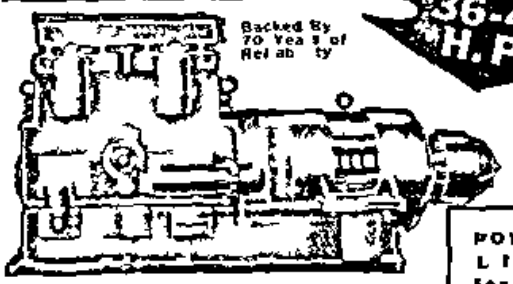


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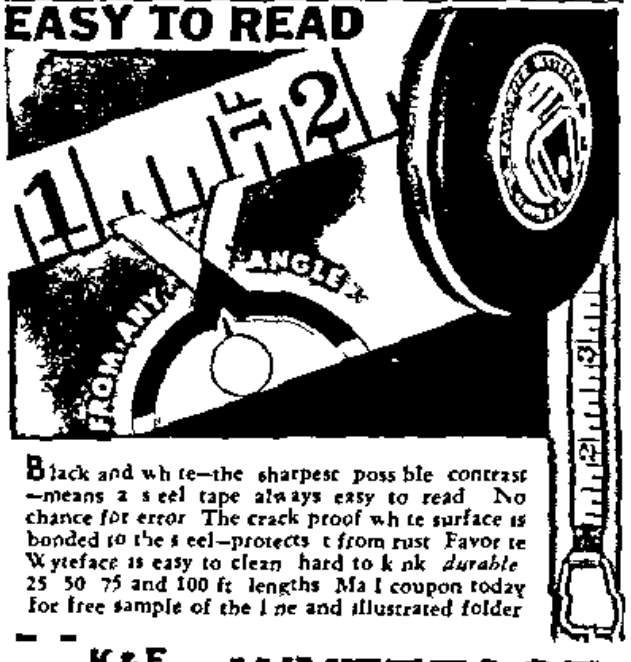
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Bombers or Battleships?

(Continued from page 56)

our Navy as engaging any enemy fleet far out on the high seas where land based planes play no part in the combat It would be the carrier planes of the two fleets that would fight it out in the air while the surface craft joined battle below So far as carrier based dive bombers or torpedo planes could shake off attackers and damage opposing warships so much would that contribute—even if not decisively—to the ultimate outcome of the engagement But it would be joint action by sea and air that counted whether it was an air bomb or a shell that finished off a hostile vessel

So from our own viewpoint air power and sea power become merged into one Taken separately neither one completely assures our security Reenforcing each other they constitute a mighty defense team to safeguard America.

Robot Bombardier Drops "Eggs" in Patterns

BOMBS are dropped automatically at regular intervals to fall on evenly spaced points on the ground by a robot bombardier invented by Ralph L. Bell of Raspeburg Md The machine automatically takes into account the ground speed of the plane

Electrical impulses release the bombs from their racks after the pilot has pressed a button or when a bomb sight is aligned with the target. Control is accomplished by a motor connected to dials which have previously been set to correspond to the speed of the plane and the intervals at which the bombs are to be dropped

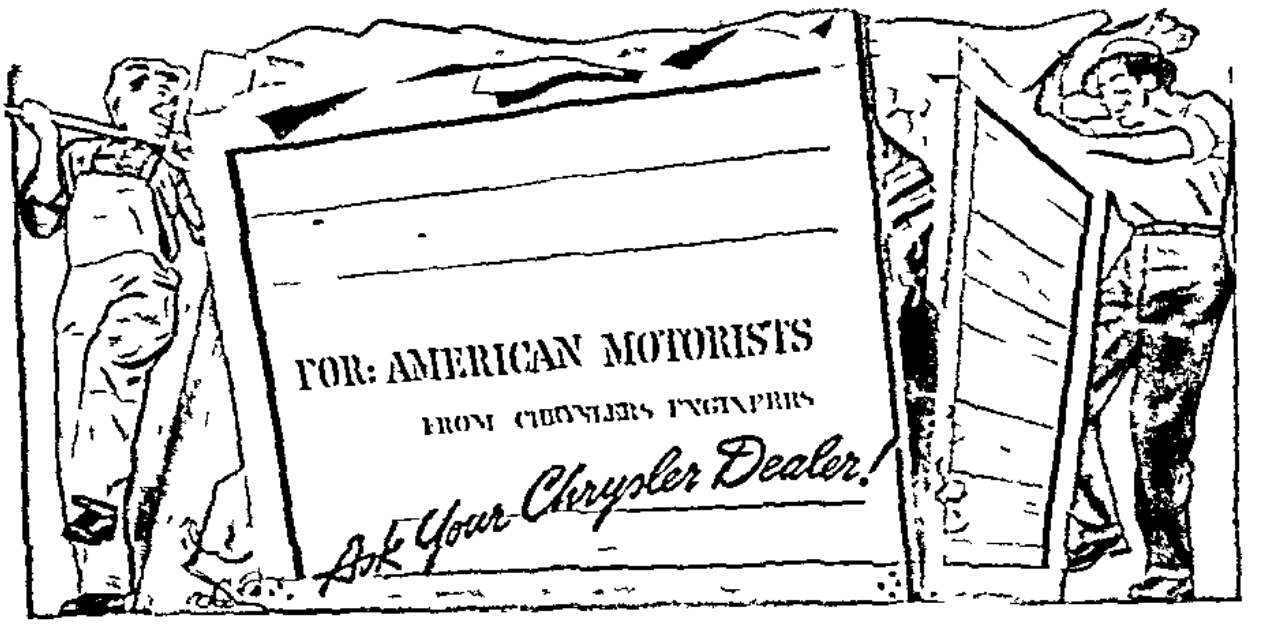
Once the device has been started it continues to drop the bombs at regular intervals until the racks are empty enabling the deadly eggs to be laid as closely or as far apart as is required by the nature of the target.

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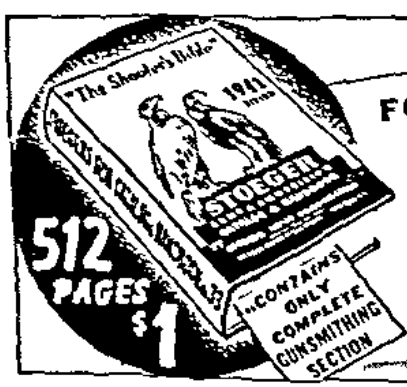


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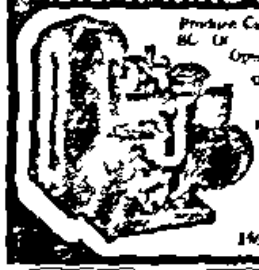
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More Guns for Our Army

(Continued from page 61)

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One of the most valuable artillery auxil iaries is the observation battalion It s the most highbrow outfit in the Army Its buck privates chat about asymptotes and its non coms live on intimate terms with the bi nomial theorem Its job is to locate the enemy s heavy guns by taking cross bear ings on their flashes and by measuring with scientific accuracy the travel from one microphone to another of the sound wave initiated when a gun is fired. The best re sults in sound ranging are obtained when fog or heavy rain blind visual observation

We have one sound and flash observation battal on in our Army The Germans have one with each of their divisions

We also are short of airplanes especially designed for the spotting of artillery fire and of the successful C 6 motorized obser vation balloon which equipped with a de tachable undercarriage with an airplane engine and propeller can move from one place to another at a speed of fifty miles an hour

But most vital is the Army s need for more guns with which to do its national defense job Official figures are not obtain able but it is doubtful that we have more than one eighth the number we should have Deciding on just how many guns and just what sort of guns the Army needs is the Army s job Making sure that the Army gets those guns is the job of every American citizen

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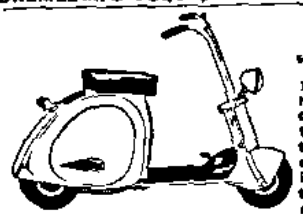
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(Continued from page 85)

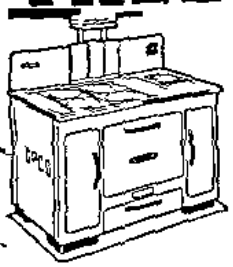
Insects with similar habits and even with 'W s on their wings are known to appear in the Ural Mountains of Eastern Europe Another mistaken belief which has been given wide currency is the idea that adult cicadas never take nourishment It has been demonstrated that in at least some cases they insert sharp little beaks into plant tissues and drink sap However, the damage caused by these insects is negligible

Recently, scientists have begun a new line of cicada investigation the study of their little known activity below ground. At the University of Kansas Dr Ray mond H. Beamer is now raising cicadas in tubs of dirt in which goldenrod roots supply the needed sap Out of such researches may come the discovery that even the so-called annual cicada the familiar noisy green dog-day harvest fly may take more than one year to develop and that all ci cadas are really periodic, each having its own cycle of years needed for its develop ment.

In any case the seventeen year variety holds the record for the length of time required to reach maturity The successive appearances of these insects form a sort of slow motion insect clock recording time in seventeen year intervals Only twenty six times has this clock completed a revolution since Christopher Columbus discovered America Only eighteen generations of the cicadas have appeared since the Pilgrims landed at Plymouth only ten since the American Revolution and only four since the Civil War Although each brood of the seventeen year cicada in northern states—and the thirteen year cicada in southern states—requires its full period to develop there are different broods so that every year, somewhere in America periodic cicadas are appearing The present widespread brood Number XIV, is celebrated as the one first seen by white settlers

As this is written, pale antlike creatures are already hatching from the eggs laid in twigs by the female cicadas They are dropping to the ground and disappearing from sight, beginning again the cycle which last commenced in 1923 Vast and sweeping changes—elections wars scientific advances —will occur during the years they will burrow through the darkness of the soil Then as though at a given signal in the year 1957 they will tunnel upward to the surface That emergence seventeen sum mers hence will complete once more the strange cycle of their astonishing existence

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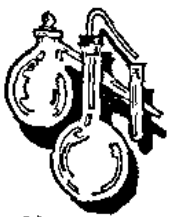
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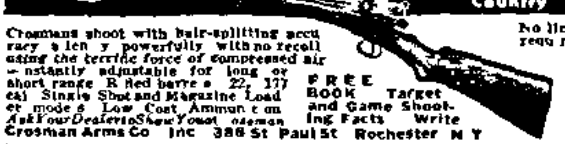
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•

If a coarse thread is used on a part of small diameter it is likely to weaken the core so it will not stand the strain of the cut For this reason a multiple threading operation rather than a coarse thread is advisable when a more rapid advance is desired than that provided with a standard thread

• • •

There are many ways to reduce manufacturing costs For example a milling machine hand had seven minutes to waste for every piece being automatically machined so a small drill press was installed nearby to keep him busy It proved profitable to both employee and employer

• • •

A new kind of paste makes prussian blue seem an antiquated product for testing scraped ground or lapped surfaces with master gauges

• • •

A manufacturer of a certain machine gun is reported to have said that 101 lb of raw materials are required to produce 18 lb of finished parts From a 1940 manufacturing point of view something appears to be decidedly wrong

• • •

A tool post grinder often proves useful in connection with a shaper but I recently discovered that an electric drill doesn't take a back seat in this respect either If you use your ingenuity you can devise several means to brace it on the tool post slide

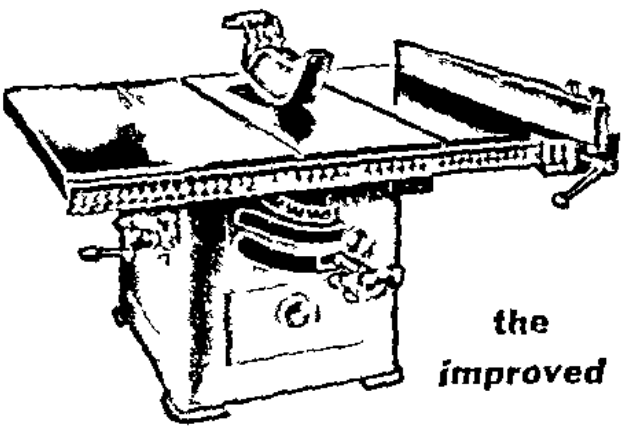
• •

The way oil is splattering around screw machines and turret lathes in some plants, one would think that cutting oil costs no more than water That accounts for certain operators who would look better with rubber boots and an umbrella Others doing the same work are able to wear a white apron

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Detecting Thin Internal Cuts

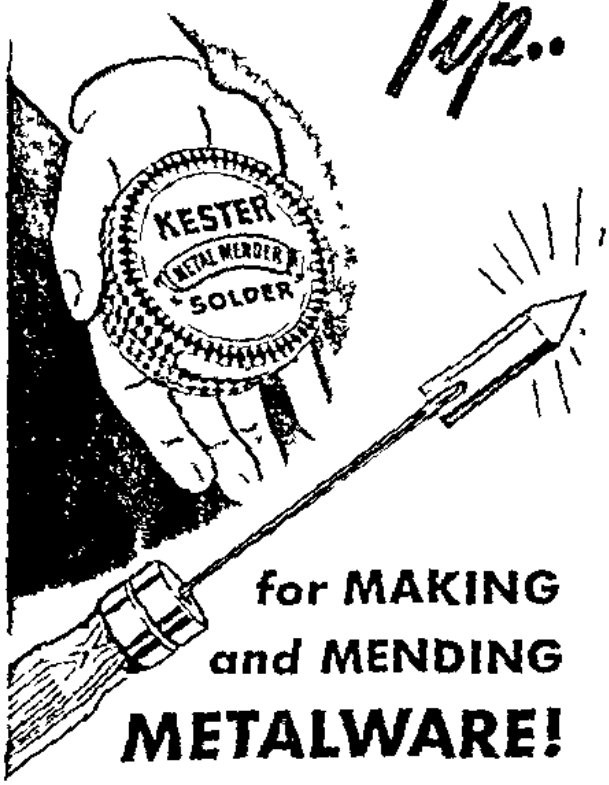
It's a trick from the old school but you can detect audibly the removal of even .0005" stock while threading internally Attach fine music wire to the external surface of the work, connect the other end to a small cylindrical cardboard box, and use it as an ear phone —H J C

Toolmaker's Clamp Acts as Small Lathe Dog

AN ORDINARY toolmaker's clamp can be made to serve as a lathe dog by fastening a bolt in the faceplate of the lathe to drive it, as illustrated —C W W



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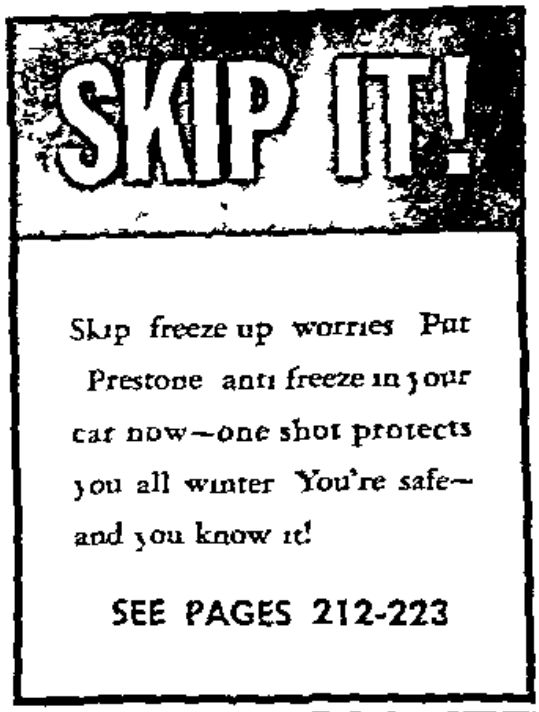
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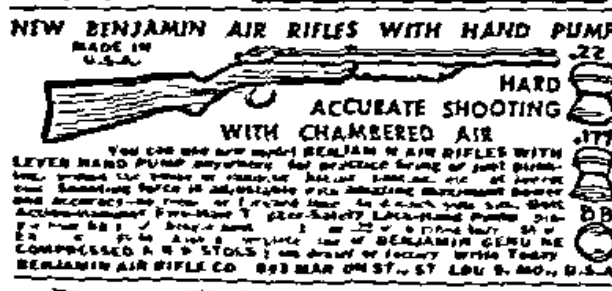
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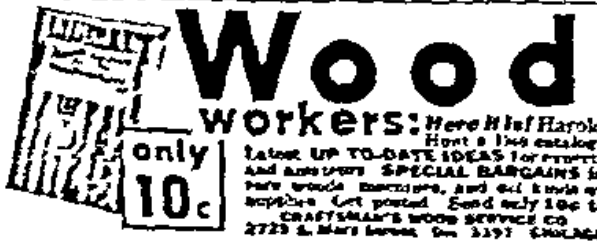
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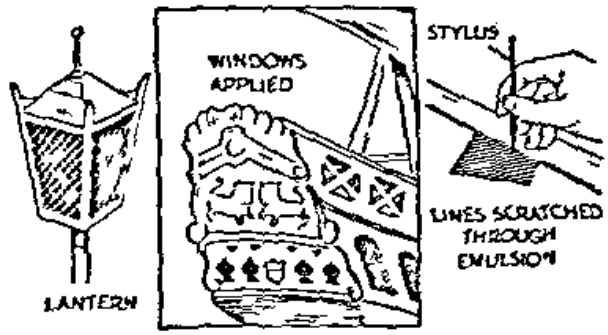






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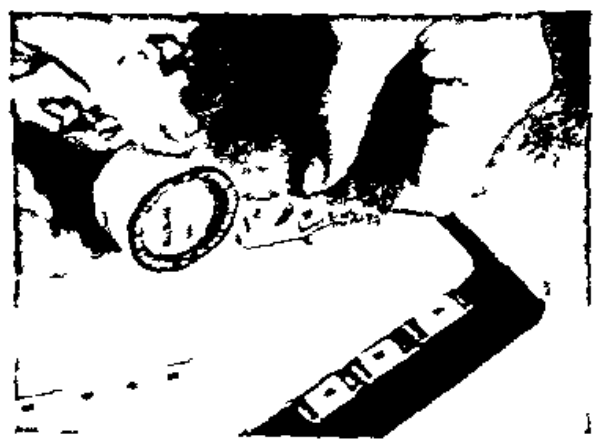
The emulsion is scratched with a stylus and then coated with paint The glossy side faces outward

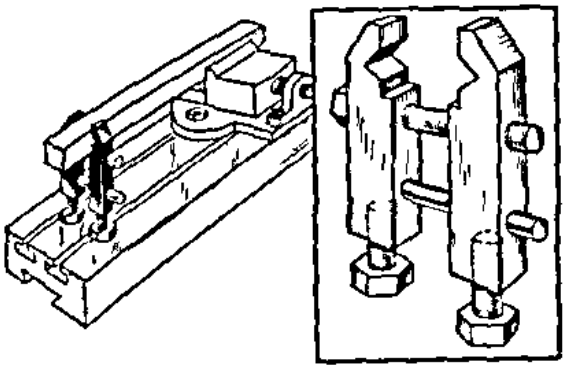
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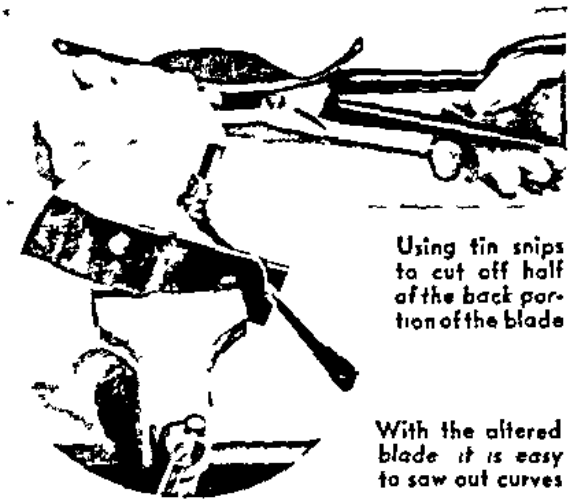




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Using tin snips to cut off half of the back portion of the blade

With the altered blade it is easy to saw out curves

WITH an ordinary hack-saw blade it is practically impossible to cut curves. This can be done, however, by cutting off about half of the back portion of a flexible-back blade with tin snips as shown. It is wise to test the blade at the back edge before attempting to cut, as some varieties may be too brittle. If the blade can be bent with pliers, it may be cut. A blade so altered can be used to cut fairly small curves, as shown above.—BENEDICT BRONSON.

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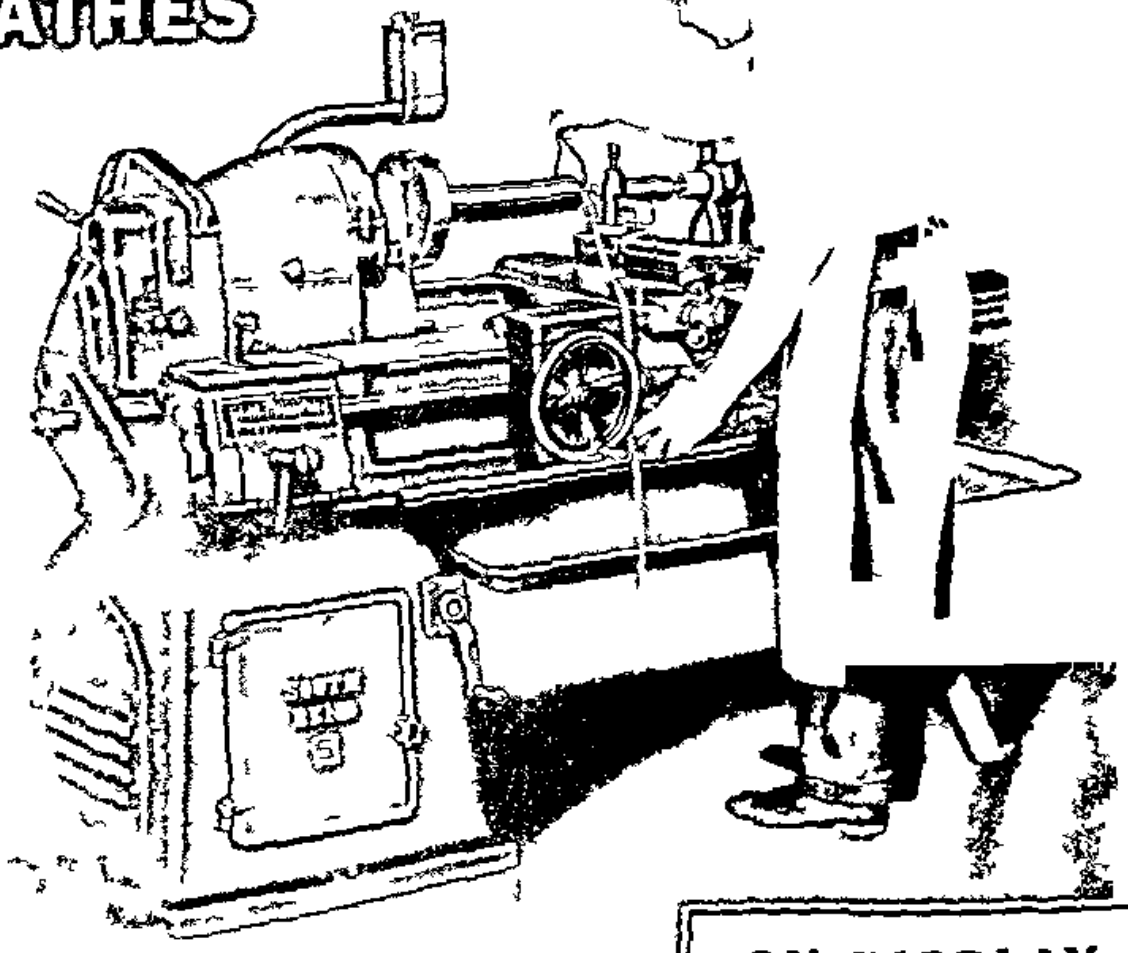
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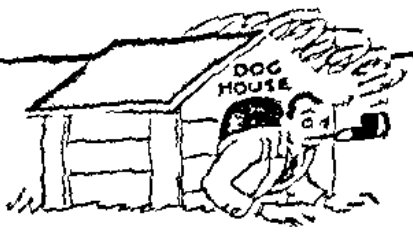
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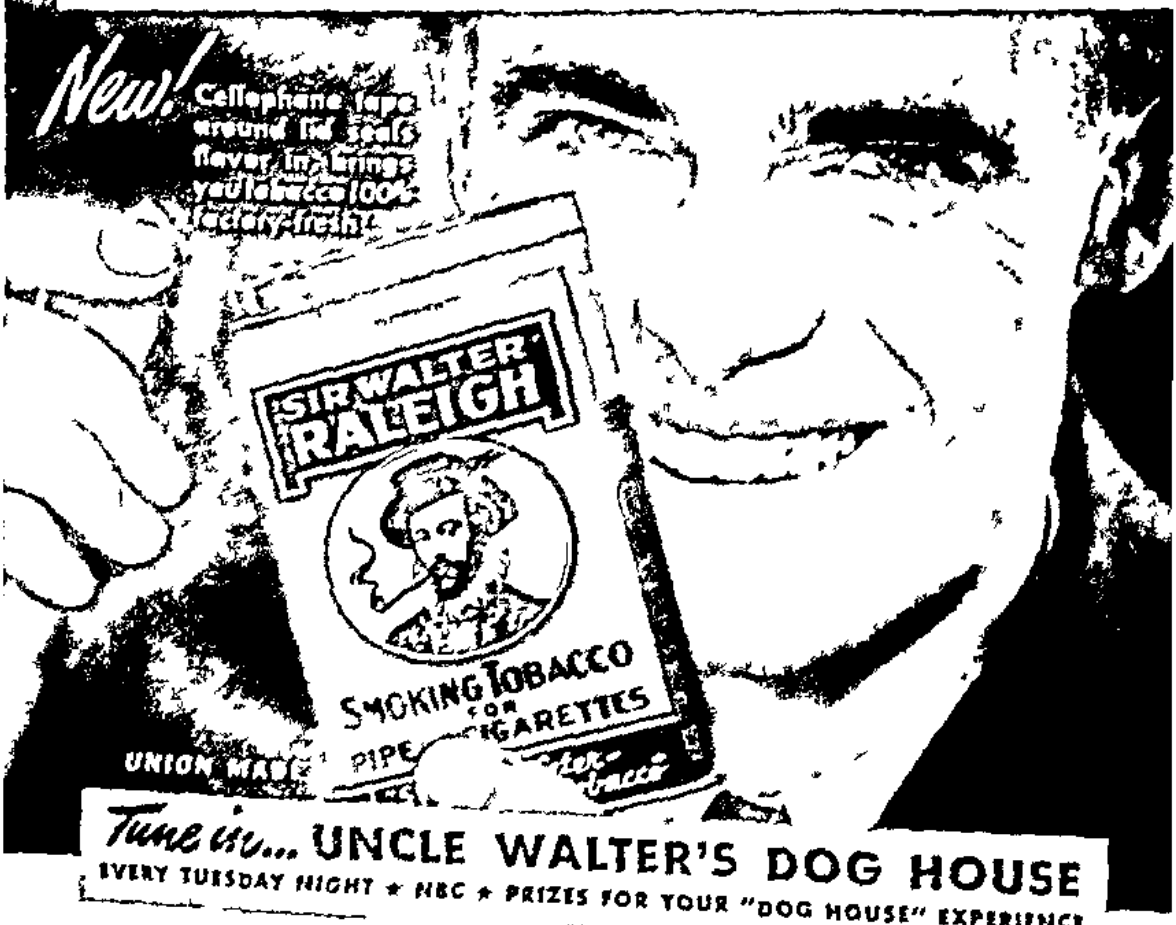
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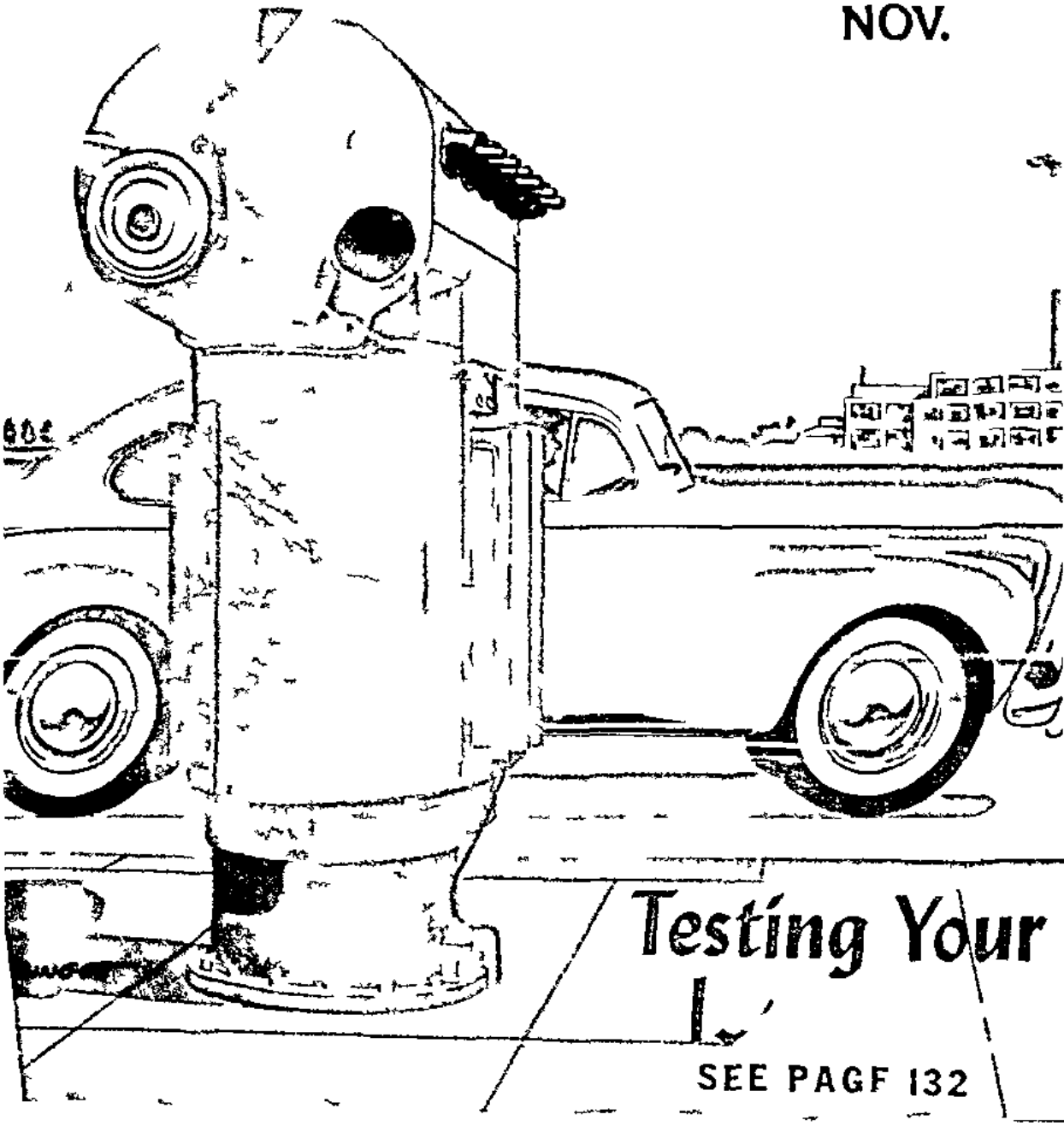
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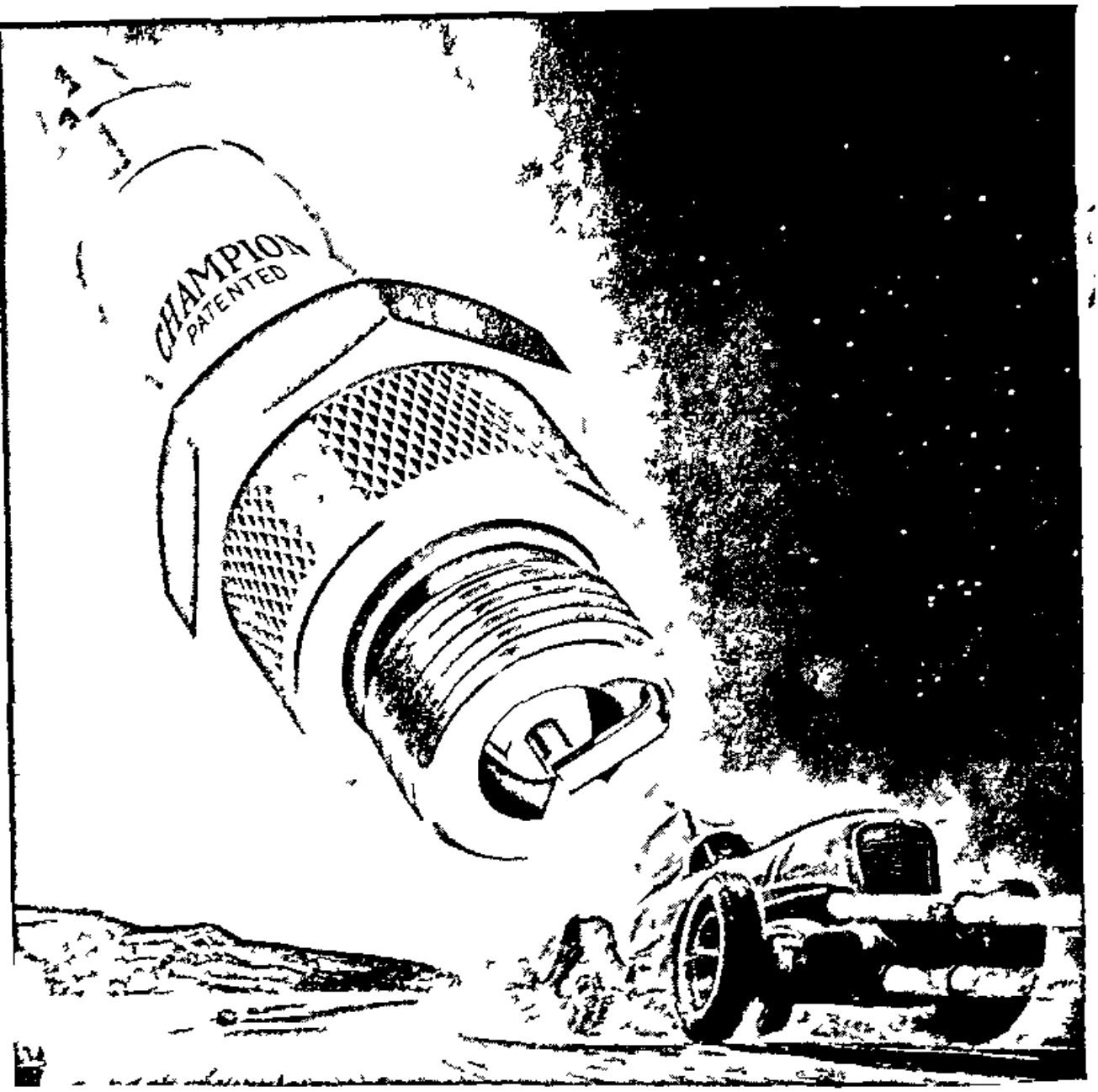
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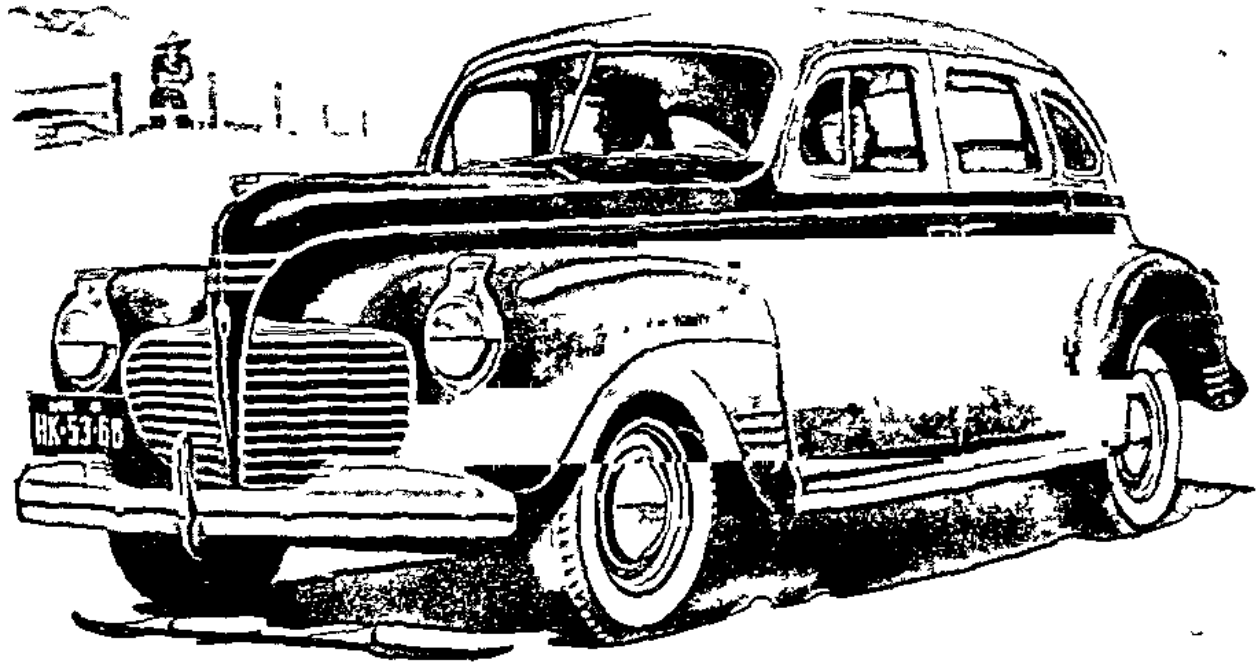
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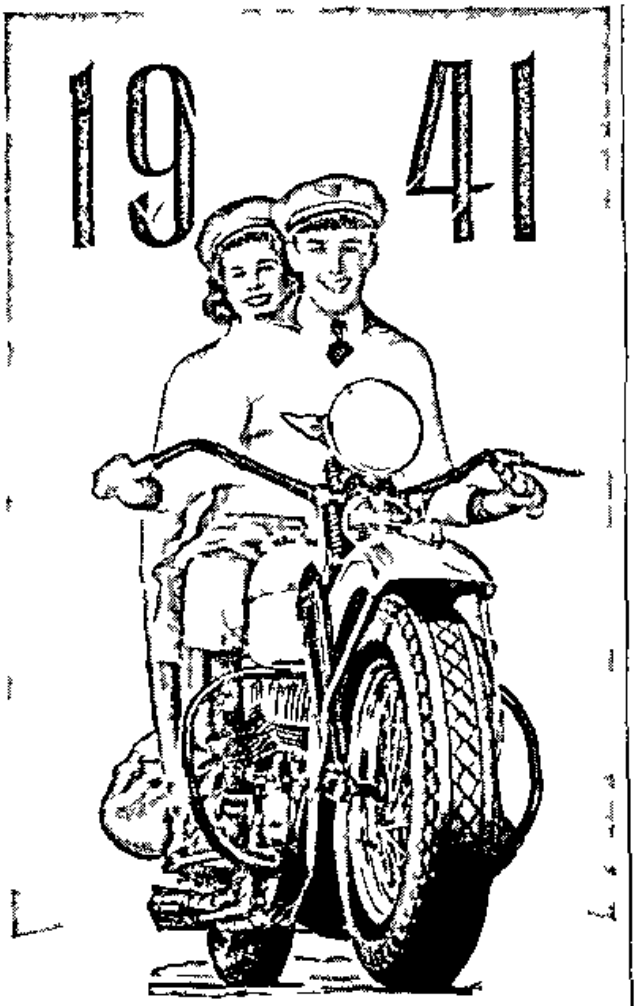


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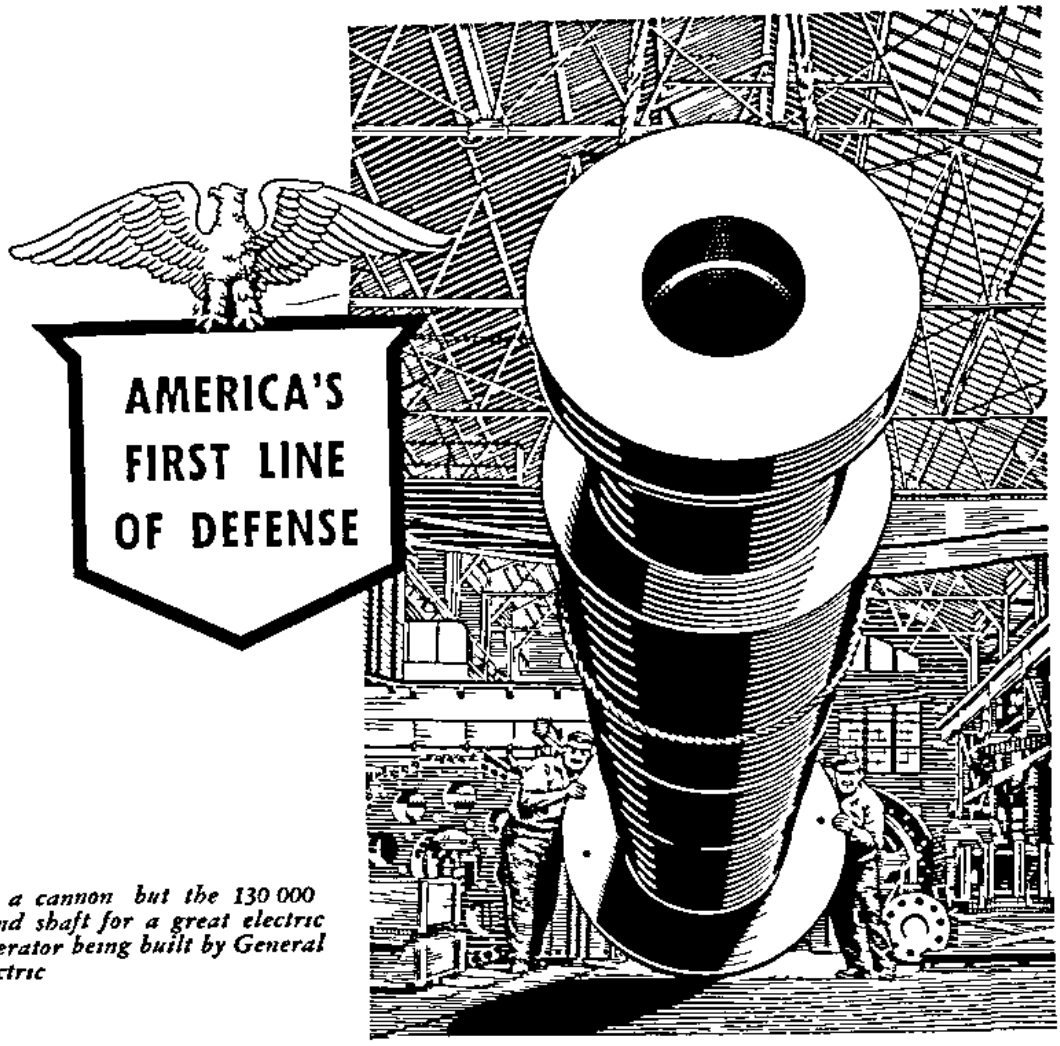
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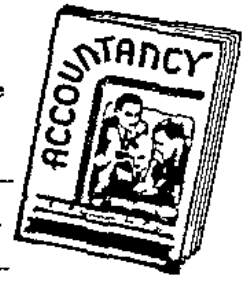
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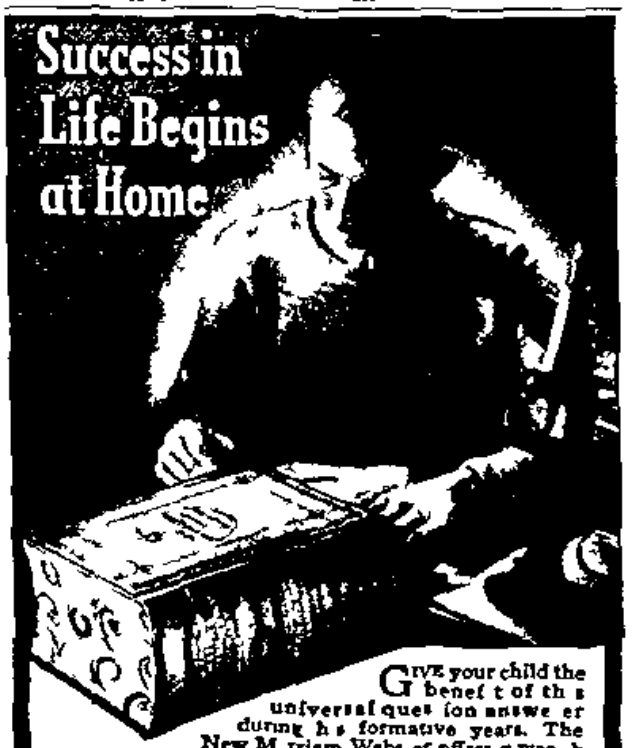
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See Page 56

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Chief Operator Broadcasting Station

Before I completed your lessons I obtained my Radio Broadcast Operator's license and immediately joined Station WMPC where I am now Chief Operator
HOLLIS F HAYES
39 Madison St.
Lapeer Michigan

Service Manager for Four Stores



I was working in a garage when I enrolled with N R I. I am now Radio service manager for the M..... Furniture Co. for their four stores.
JAMES E. RYAN
119 Pebble Court
Fall River Mass.

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I repaired some Radio sets when I was on my tenth lesson. I really don't see how you can give so much for such a small amount of money. I made $600 in a year and a half and I have made an average of $10 to $20 a week—just spare time.
JOHN JERRY
1509 Arapahoe St. Room 17
Denver Colorado

$200 to $300 a Month in Own Business



For the last two years I have been in business for myself making between $200 to $300 a month. Business has steadily increased. I have N R I to thank for my start in this field.
ARLIE J FROEHNER
300 W Texas Ave.
Goose Creek Texas

I WILL TRAIN YOU AT HOME

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J. E. SMITH, President
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Radio broadcasting stations employ operators technicians. Radio manufacturers employ testers inspectors servicemen in good pay jobs. Radio jobbers dealers employ installation and servicemen. Many Radio Technicians open their own Radio sales and repair businesses and make $30 $40 $50 a week. Others hold their regular jobs and make $5 to $10 a week fixing Radios in spare time. Automobile Police Aviation Commercial Radio Loudspeaker Systems Electronic Devices are other fields offering opportunities for which N R I gives the required knowledge of Radio. Television promises to open good jobs soon.

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Our Readers Say



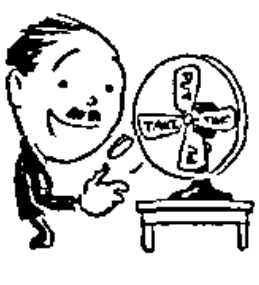
Should Plane Windows Be Bigger for Such a Big View?

As an appreciative occasional user of our air lines I have no complaint against the splendid service they all render That they are safe to use is attested by the records That they're fast no one can dispute. Comfort service individual attention at every turn and last but not least a remarkable economy all combine to make flying just about the most attractive way of getting where you want to go these days But I do have a bone to pick The windows on the commercial planes of today are so small that you almost have to break your neck to see out of them I refuse to be one of those blase passengers who read a book from the time they take off until they land Without an apology I confess that I sit and stare out the windows (*) with the unblushing enthusiasm that a visiting fireman displays for the big city's tall buildings Something should be done to change those tiny portholes into first-class show windows Maybe some air line official will explain.—D S Montclair N J



He Might Lend It to the Salesman Who Sells Straw Hats to Eskimos

By this time millions of electric fans in hundreds of thousands of offices and homes have been turned off and put away for another summer Talk about wasted potential energy! The guy who can think up some way to "put it to work" the year round will really have something The big electric companies would have something too, and so would their employees and stockholders in the way of increased profits from increased sale of electricity If all the fans in the country were made to turn the year round Oh well. Who wants to borrow my electric fan for the winter? I don't know where to store it in my one-and a half room apartment.—T R., Troy N Y



Don't Jump to Conclusions on That Jumping Brick

Maybe I'm just a killjoy but I'm afraid that all the work of the mathematician Perrin mentioned in the letter of A. G B., of Sacramento Calif., about the brick that on certain rare occasions might be expected to jump up in the air when its atoms got out of whack was done in vain He made his mistake when he got the impression that the atoms move every way at random It so happens that each atom moves in a straight line until it collides with another atom then the two bounce off of each other Therefore if an atom is moving straight up there is bound to be one moving straight down If this were not so there would always be more atoms moving in one direction than another and the brick would always be either sliding around or jumping up and down No doubt, he has noticed that this does not happen. While I am at it, how about a bigger automobile section? We all own cars Why doesn't Gus Wilson have a "Questions from Auto Owners column" His articles are tops He's the guy who got me interested in automobile repairing—A. J H., Lynn Mass



A bigger automobile section that should interest A J H and countless others who have requested it will be found in this issue and those to follow.—Ed.

A Reader Explains the Exploding Lamp Chimney

In regard to A. B. H's exploding lamp chimney I am not a "reliable glass factory" as he mentions but I can offer a possible answer to the question of what made the chimney go to pieces Anyone familiar with chemistry has heard of "Rupert's drops" used for a novel experiment. They can be thrown around and will not break until the surface is scratched or cut. The reason is that they are made with a very thin but tough skin, while inside the glass is under tension or pressure. The lamp chimney was probably under the same strain and when it cooled—probably irregularly because of a

(Continued on page 14)



HOW A BALKY CAR WAS MADE TO RUN SMOOTHLY BY ONE SIMPLE CHANGE



MY CAR HAD THE JITTERS. The motor missed backfired and bucked like a broncho It had no power on the hills I couldn t figure what was wrong until—

A SERVICE MAN PUT ME HEP to Auto Lite Spark Plugs They ll g ve your car new l fe" he sa d "Those old plugs now waste plenty of gas that costs you money

RUNS SMOOTH AS SILK NOW! My motor purrs l ke a kitten And say I ve sure cut my gas b lls s nce I put those new Auto-Lite Spark Plugs to work for me

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sl ght draft—the strain became too great at some point and the whole thing went to pieces—J A W Oberlin Ohio

There Are More Ways Than One of Getting Fish out of Water

YESTERDAY I decided to clean out my very heavy tropical fish bowl Under the heading Car Tips for Amateur Mechanics in a recent issue I noticed that to draw gasoline from the car tank you can use a rubber tube wrapped around and then removed from a clothespin to start the siphon I decided to try it on my fishbowl and it worked perfect ly Th s prevented me from getting dirty and fishy water in my mouth. Thanks lots—R W New York City



Afraid that R W wasted time The method he used is fine for car gas tanks and other narrow-top conta ners But in an open bowl the easiest way to start a siphon is to submerge the rubber hose until it s full pinch and withdraw one end and lower it below the water l ne Ed

Either You Get a System or You Don t Get Pictures

UNNUMBERED other camera fans are probably writing to sympathize with T U of Columbus Oh o besides myself It s no joke to spend hours taking pictures with empty film holders T U what you need is system and it is something that God didn t give you cheap You either get a system or you don t get pictures There are a lot of practical ways if you want one You could weigh each film holder before you used it If it s loaded it would weigh more I never tried it but it should work You could snap a rubber band around the empties which should work un til Junior wanted to make a model air plane I still don t think you are in such trou ble You have the films You have the kid I ll bet Junior had a runny nose that day anyway Maybe he poses better when there isn t any film in the holders Seriously did you ever try shooting pictures without film? Say now there s an idea Cheap soul satisfying and the kids always pose better under those conditions Try it some time Then just to cross the kid up have say three films ready right at the end—R V S Burlington Iowa



A Slightly Gruesome Math Problem for Budding Generals

YOUR magazine is so darned interesting that once I start to read it I can t put it down until I ve read it completely through Then I have another month with nothing to do but reread the book about ten times over Your new arrangement is swell and it helps us to look up back ar ticles with very little trouble Speaking of articles, the one start ed recently on radio for beginners is tops And now I have a problem that will amuse you while you re waiting for the second half of some Saturday afternoon football game to come in over the radio but should leave you time to spare to hear the changes in the line up Here it is After a repulse a general found that only 5 400 men more than half of h s former force were fit for service as 400 more than one fifth were wounded and 500 more than one eighth were killed missing or prisoners What was his force before the battle?—A D N Vancouver B C Canada



What Bothers a Lot of Us Is Making the Darn Stuff Grow

HAVING absorbed an untold number of ideas—screwy and otherwise—from this column I would like to submit one of my own leaving it to others to decide which heading it belongs under The heat of summer makes a man s whiskers grow faster than they do in winter Supposing you stayed in a place that was air conditioned Would that retard the growth somewhat? If so would it be possi ble to prevent the growth entirely by liv ing in a very cold place? Or perhaps kill the growth by sud denly thrusting your face into a cold cham ber especially made for the purpose? Such a machine could also be used to rid women of excess hair on their legs and with certain

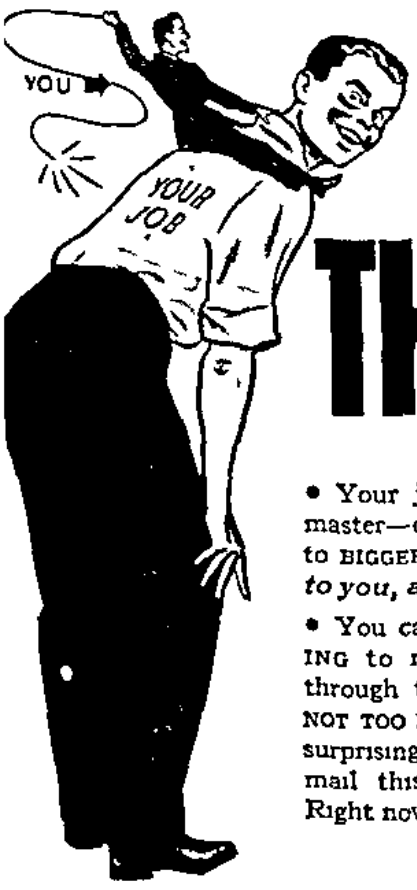


(Continued on page 16)



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modifications it could take the place of a haircut As you can see the possibilities are endless —J S Yonkers N Y

He ll String Along with Mager, Hook, Line and Sinker!

Was amused at the story about the conversational catfish, on page 127 of your October issue that talks on the radio When removed from his (?) tank in the Staten Island N Y zoo the story ran the fish made curious sounds into the studio microphone as part of a natural history program that was sent out from a New York radio station Imagine my surprise when I turned over the next page to Gus Mager s UNNatural History and read that No fish has ever acquired vocal organs of any sort I m inclined to string along with Mager —M R Buffalo N Y

Mager was right and so was the fish story notwithstanding Croakers for example are defined by Webster as "Any of various fishes that produce croaking or grunting noises as certain grunts and surf fishes" The noises occur when the fishes are out of water —Ed

He Wouldn t Worry About That When the Bombs Started Falling



The September issue of PSM was certainly a honey I want to compliment you on your cover and on the career of David Sarnoff I have just looked at With the Inventors and Readers Say The letter from M L Z about the new invention of the soldiers helmets that bounce the bullets away was very clever I also noticed the invention of Andre D Amico in With the Inventors of the house that disappears into the ground as a protection against aerial bombs What would happen if the concussion of a bomb happened to break the hydraulic plunger or if tons of dirt covered the roof so that the weight was so great that the plunger couldn t raise it again or if the metal spread out?—A C Z Valley Stream N Y

This Should Fold Up the Umbrella Problem

The answer to P M D s problem about the partially open umbrella is 10° 18 By constructing a triangular pyramid the base of which is at right angles to the center stick of the umbrella, with two of the ribs forming the other sides it was easily worked out. A line was drawn in the base perpendicular to one side of the base and continued up to the apex to aid in the solution —J V., Montrose S D

The Navy's Own Mascot, Complete with Whiskers and Horns!



The Navy certainly was thinking of its football team when it made the aircraft carrier *Lexington* (PSM Sept 40 p 42) Your picture of her at any rate certainly gives the lifelike impression of the Navy s mascot the billy goat complete with whiskers and horns I wonder if the Army goes around with mules on its tanks?—S Z Fairfield Conn

Reader Points Out that Almo Was Not a "Seeing Eye" Dog

May I call your attention to an article appearing on page 72 of the September issue of your magazine referring to the first dog brought to this country to guide the blind? Almo was not the first Lux von La Salle was the first dog brought here from Europe for the purpose and was trained here in this country at the La Salle Kennels in Minneapolis Minn for the late Senator Thomas D Schall Almo was a Masters Eye dog and not a Seeing Eye The Seeing Eye represents a corporation in New Jersey while "His Masters Eyes represents a school in Minneapolis —G G Chicago Ill

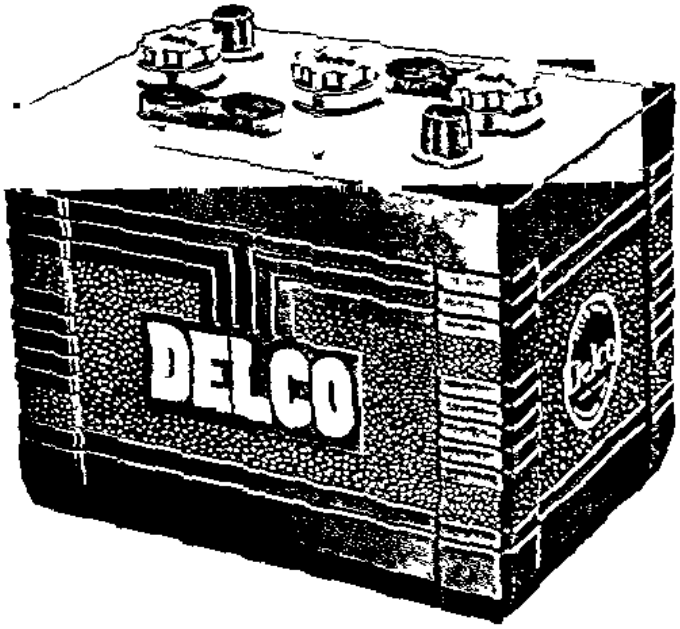
We're glad to have this case of mistaken identity cleared up —Ed

There's Still Quite a Gap, Still, It's Quite a Collection



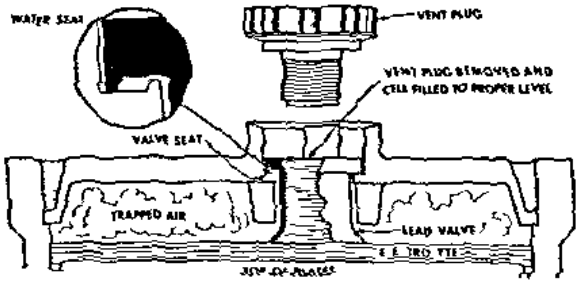
In the last few issues of your magazine I have become interested in what the readers have to say I thought maybe it would be of interest to these readers and perhaps to yourselves to know that I have kept every issue of your magazine from October 1934 to the present, which will very soon make seventy two copies all in perfect condition I have secured issues of your magazine moreover from 1872 to 1874 bound in four volumes.—P A. H. Minneapolis Minn.

The New DELCO ELECTRO-LEVEL AUTOMATICALLY ELIMINATES OVERFILLING

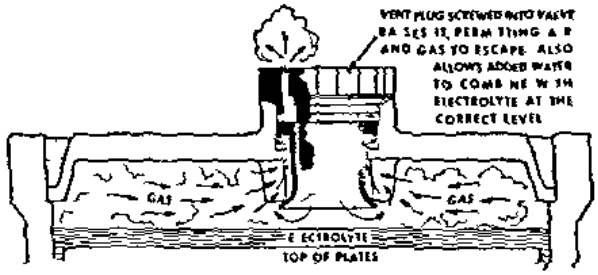


When the electrolyte level in a battery is too high, acid is sprayed through the vent holes by the pressure inside the cell . . . pressure that is built up by the release of gases when the battery is being charged. This acid spray attacks battery connections and battery carrier. The new Delco battery is protected against these conditions by the Delco Electro-Level, which automatically prevents overfilling when water is added.

HOW THE DELCO ELECTRO-LEVEL WORKS



Vent plug removed for filling—valve forms air lock when electrolyte reaches proper level. Notice particularly the *water seat formed when the edge of the valve drops into* the layer of water retained by the ridge around the valve seat. This layer of water is replenished by condensation eliminating any possibility of a leak in the air lock when the lead valve is in position for filling.



Vent plug screwed in—valve is raised to permit escape of trapped air and gases from the cell through the passage *and the vent hole in the plug. Notice here the efficient* baffle arrangement through which the gases must pass. This condenses moisture and breaks up the acid spray which might otherwise escape to damage the battery carrier and connections to the battery

Stop in at your nearest Delco battery dealer's and let him check your present battery on the Battery "Life Expectancy" Chart. He has a Delco battery that is exactly the right size and type for your car.

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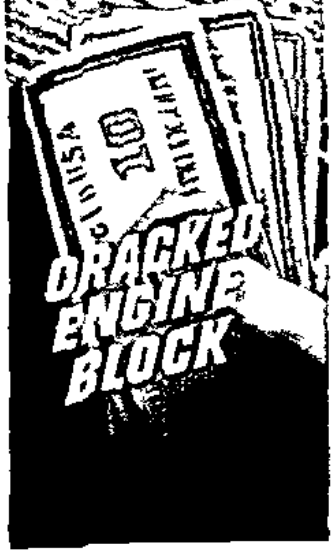
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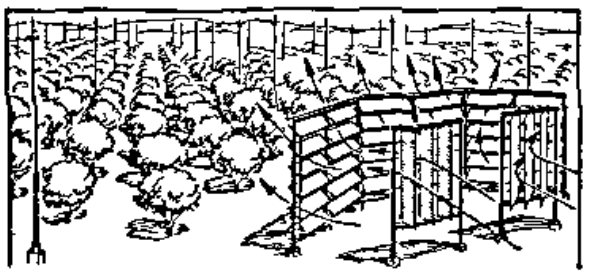
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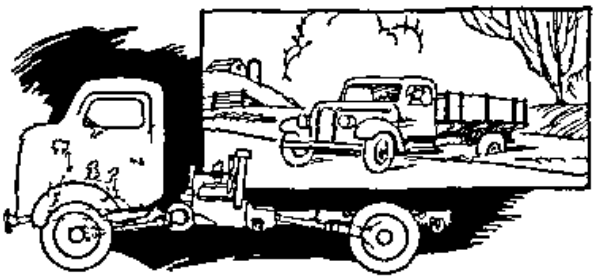
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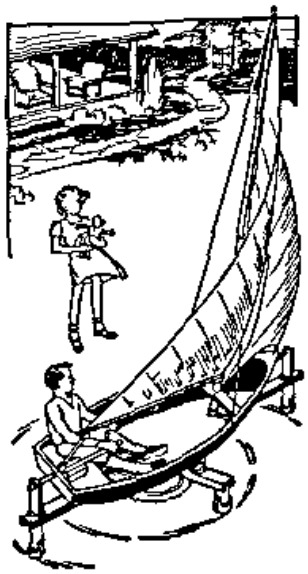
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engine transmits its power independently in conventional fashion to the rear axle Either engine or both may be used at the will of the driver The system is particular ly useful for pulling out of d tches and for driving through soft earth mud or snow CHANGING THE MATERIAL of which an item is made does not in itself constitute an in vention LEARNING TO SAIL A BOAT in the safety of your own back yard is possible with a device developed by Seifert W Rous seau, of Port Wash ington N Y The mast sails and tiller of a small boat are mounted in their regular way aboard a dum my hull which is made so that it w ll tip or heel in the wind The entire assembly can be revolved to port or starboard by means of a revers ible motor op erated by the tiller Used in a wind the device is said to duplicate exact ly the response of a real boat to tiller and sail adjustments ALL INVENTIONS are referred to by the Patent Office as improvements WITH ITS TUNING DIAL at the level of the eyes of



(Continued on page 22)

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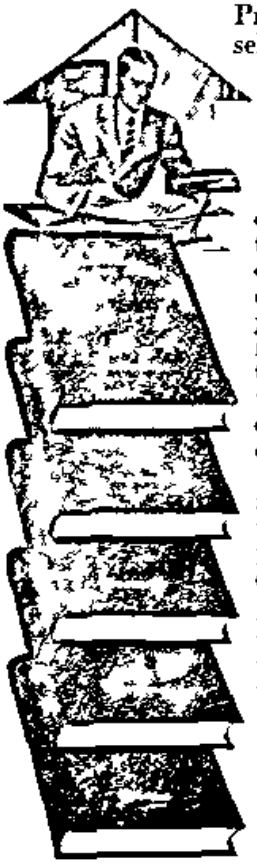
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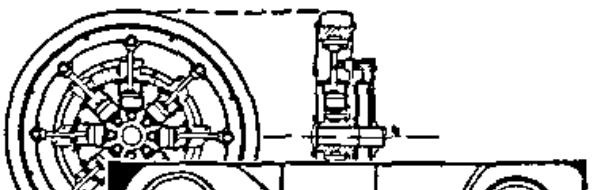
With the Inventors

(Continued from page 20)

an adult standing in front of it, a radio receiver recently patented by Donald V. Marsh of Lexington, Ill., boasts a number of other novel features. Control knobs, for example, are at waist level for easy manipulation. On each side near the top, lights swing outward at the touch of a button, making the set serve also as a reading lamp. Beneath each light, concealed bookshelves mounted on hinges may be opened out from the cabinet when desired. The inventor points out that the outfit not only serves as a floor lamp but places the tuning controls above the reach of small children.



A MODEL OF YOUR INVENTION is rarely required with your patent application. . . CONVENTIONAL AUTOMOBILE SPRINGS might well be eliminated entirely by wheels that contain their own spring mechanism. Such wheels, using cylinders, pistons, and piston rods as spokes, have been perfected and patented by John Bartho, of New York City, and John T. Ackerson, of Radburnfair, Lawn, N. J. The inventors point out that heretofore any springing action built into wheels has tended to let power applied at the hub turn the hub faster than the rim.



With the present design, however, they claim a positive drive is automatically provided by short plungers that engage the outer end of each piston rod as it passes through a part of its revolution. The plungers, on arms connected to the driving hub, extend and retract as one end slides along.

(Continued on page 24)

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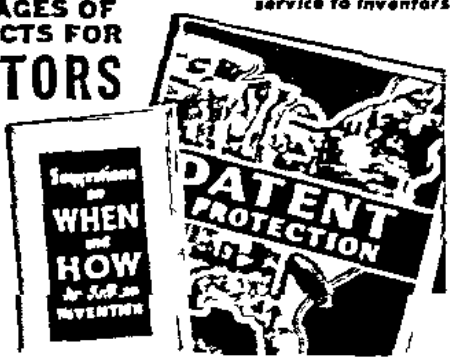


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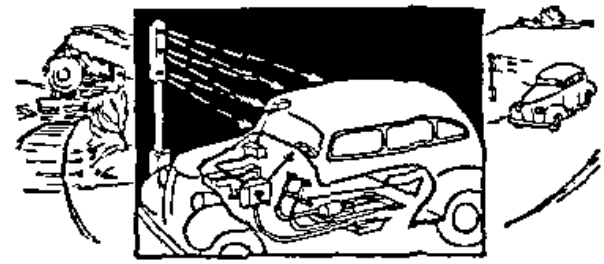
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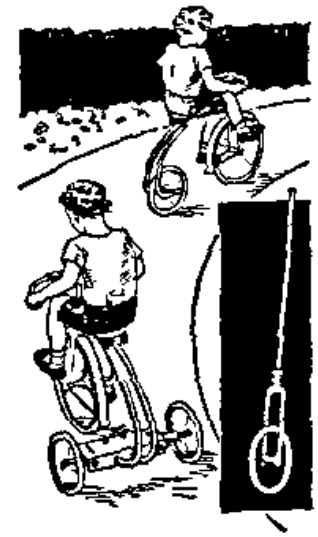
With the Inventors

(Continued from page 22)

a ringlike track, engaging the piston-rod spokes to transmit power . . . EXTENSION OF THE TERM of a U. S. patent can be obtained only by a special act of Congress. MAKING SURE THAT CARS, trucks, and



busses halt at railroad grade crossings when a train is coming is the purpose of another automotive invention. An approaching train turns on a set of lights on a roadside post near the tracks. A brilliant fan of light directed across the road strikes a photo-electric cell mounted on the side of any passing vehicle. The cell, through an electrical hook up, operates a valve which allows the vacuum in the car motor's intake manifold to release the car's clutch and automatically apply the brakes. Arthur W. Cowles, of New Hampton, Iowa, is the inventor of the system . . . A YOUNGSTER'S SCOOTER THAT "grows up" with its owner is the invention recently credited to L. R. Johnson, of Cleveland, Okla. Built as a tricycle, with one wheel and its pedals forward, and a pair of wheels behind, the device is suited to small children. Later, while a child is still too small for a conventional bicycle, the two rear wheels of the tricycle can be removed and one inserted on a short axle in the specially designed rear fork. A small bicycle is the result, just the right size for its owner, and ideal for teaching a youngster the principles of balancing himself on a two-wheel vehicle. The extra wheel can be attached to a broomstick and used as a pushing wheel, or it may be kept as a spare for replacement use.





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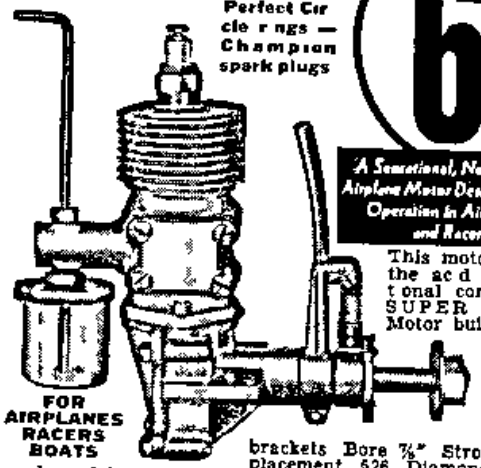
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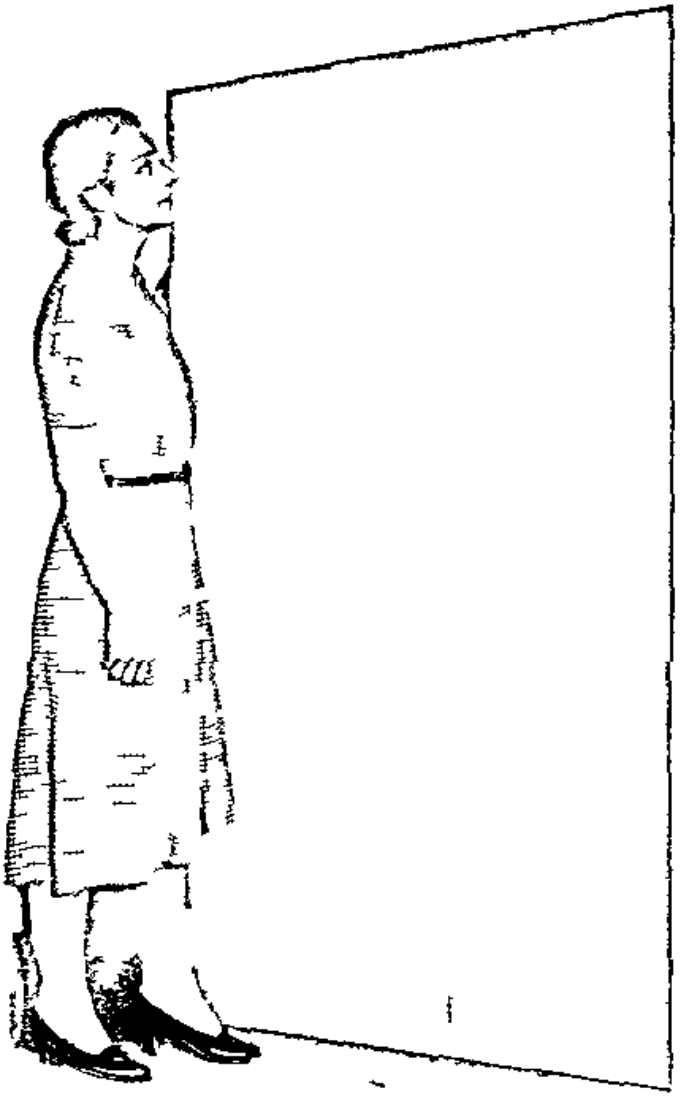
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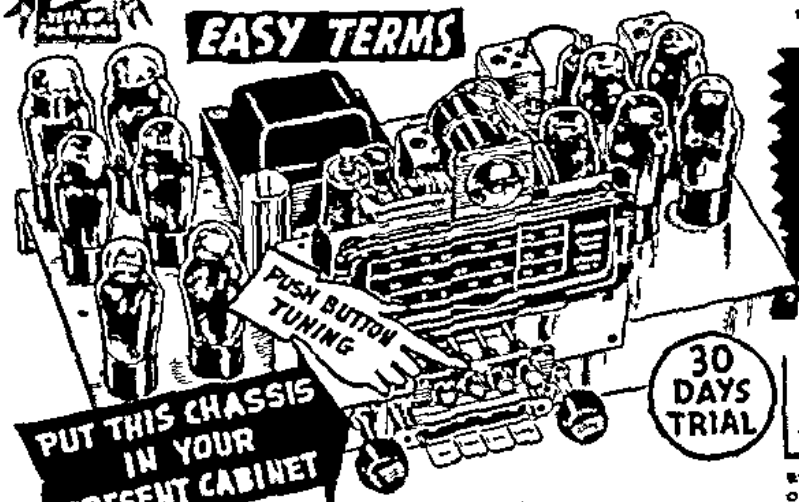
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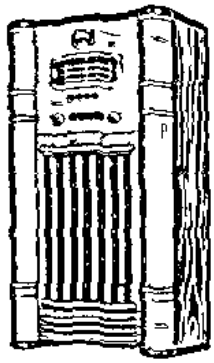
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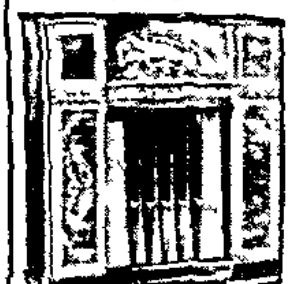
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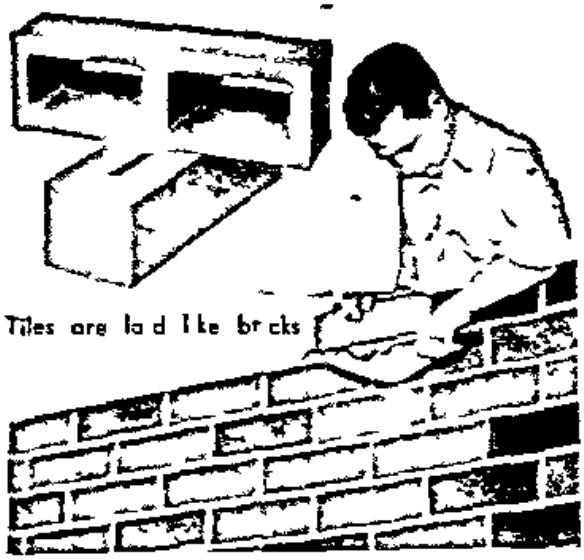
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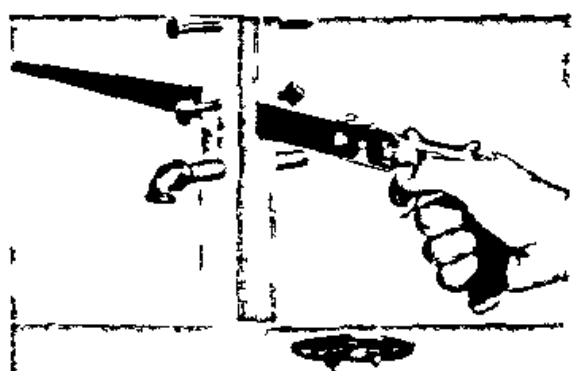


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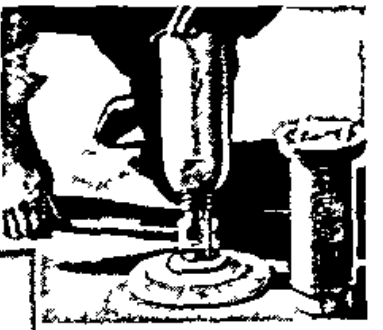
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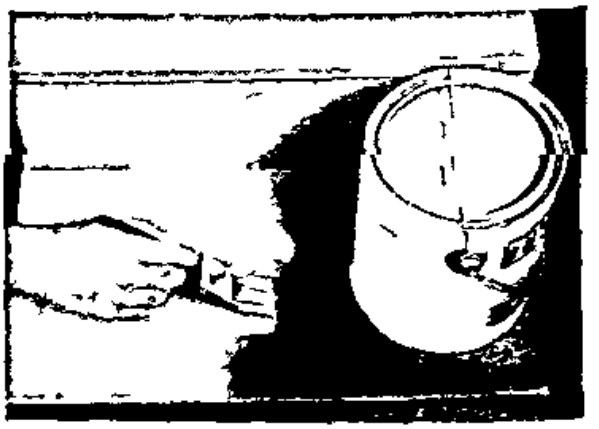




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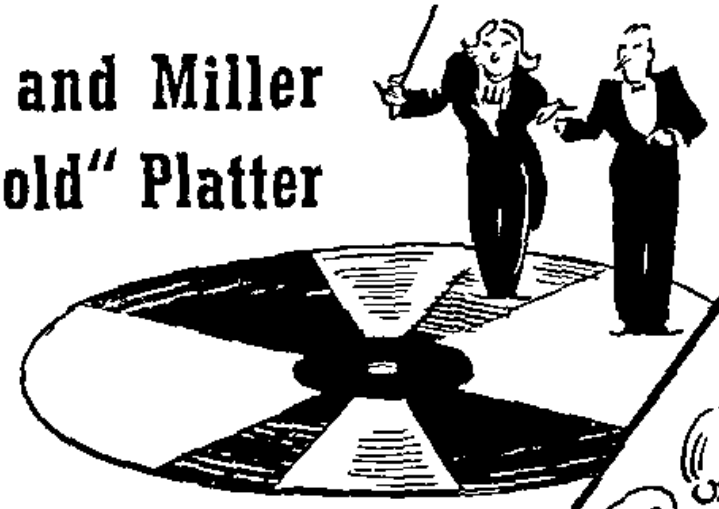
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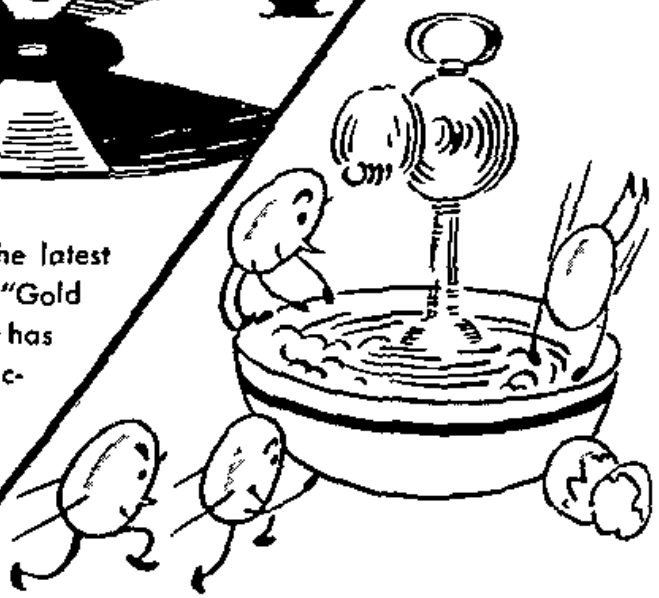
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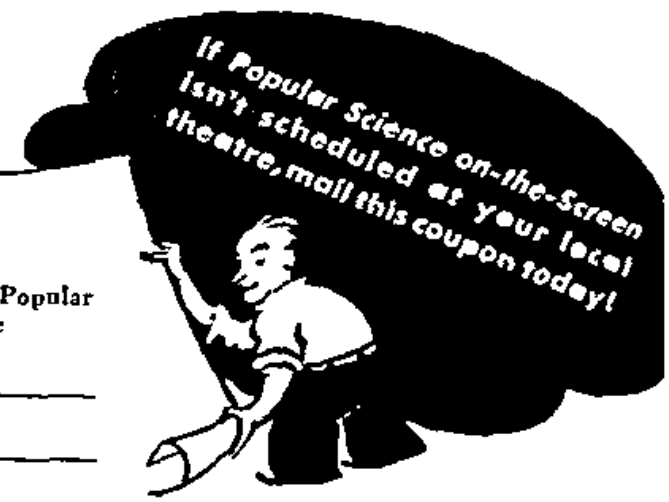


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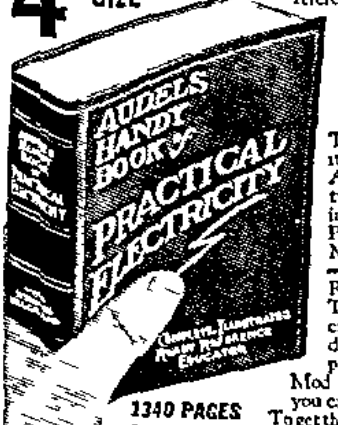
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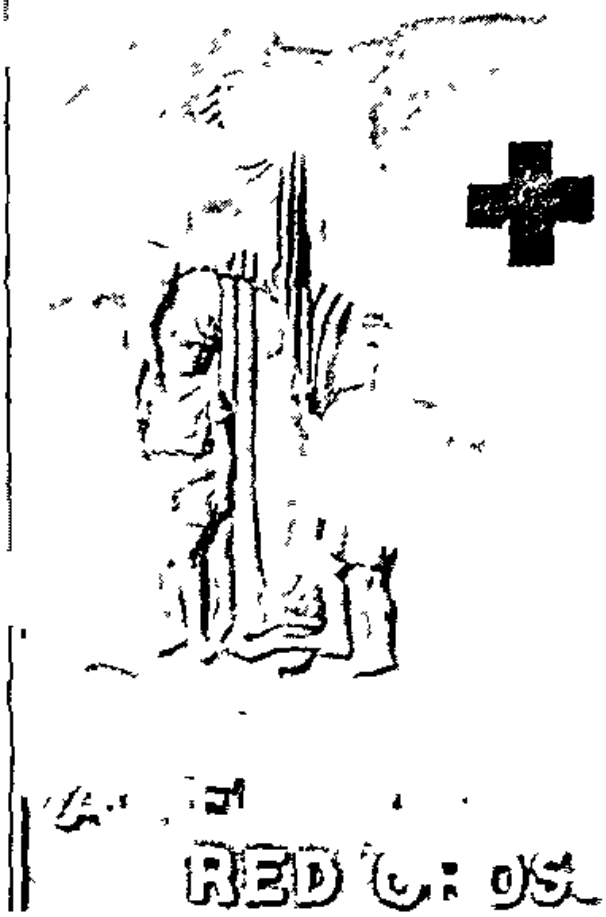
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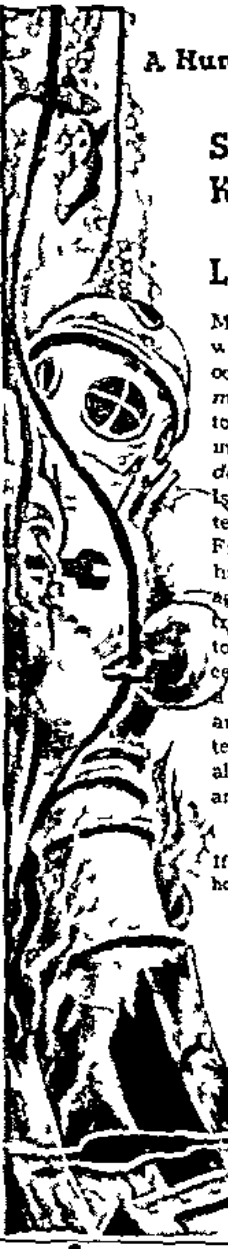
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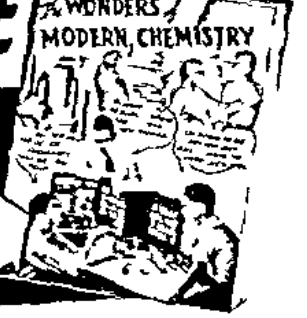
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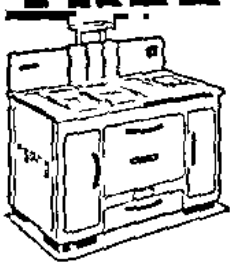
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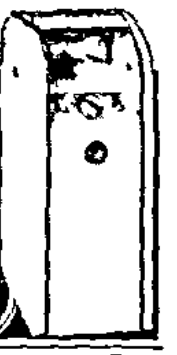


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ENLARGEMENTS 5x7 18c 8x10 30 Rolls Developed Christmas Cards Send negative dime for samples Photo-Hall, Box 12 Kingsbridge Sta N Y C

LOOK! Get Sixteen prints per roll 25c plus valuable coupon on 3—4 x 6 2—5 x 7 or 1—8 x 10 enlargement Modern Studios LaCrosse Wisc

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ROLLS developed two prints each and two *free enlargement coupons 25c reprints* 2c each 100 or more 1c Summers Studio Unionville Mo

ROLLS developed—Two beautiful double weight professional enlargements & Never Fade prints 25c Century Photo Service LaCr sse Wis

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PROMPT Service Rolls developed two Velox prints each negative 25c Hench Studios Harrisburg Penna

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HUNTING trapping camping equipment Used guns Catalog Howe Coopers Mills Maine

STAMP COLLECTING

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Readers are invited to take full advantage of the stamp offerings available through ads asking for *Approval Applicants*. Such applicants receive a selection of stamps on approval which may be purchased at prices indicated Payment and return of undesired stamps should be made within ten days after receipt unless otherwise specified by advertiser Applicants who fail to follow these instructions become subject to Section 2350 Postal Laws and Regulations 1932, which provides extreme penalty for obtaining property by false pretense

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GIANT packet 200 all different from Africa South America, Asia South Sea Islands etc Includes world's smallest stamp triangle and diamond shaped stamps, animal stamps Nicaragua Will Rogers' airmail, many others Also packet 27 different United States (cataloging 50c) all obsolete including $4 denomination commemoratives etc Total catalogue price over $5.00! Everything for only 5c to approval applicants! Mystic Stamp Company Dept. 55-N Camden, New York

FREE The Stamp Finder! Send today for big new edition, fully illustrated, enabling you instantly to identify all difficult stamps! Also fine packet strange fascinating stamps from Bosnia Herzegovina Monaco Patiala Cyprus etc including maps ships animals and strange scenes All free to approval applicants inclosing 3c postage Garcelon Stamp Co., Box 918 Calais Maine

SUPER-Wonder offer comprising stamps from Afghanistan (oblong) Transjordania (emir) North Borneo (buffalo) Manchukuo (mausoleum) Sudan (native) Cameroon (beauty) Iraq (late king) Brunei (boating) this entire lot absolutely free for 3c postage to approval applicants Big illustrated lists free Kent Stamp Co G P O Box 87 (24) Brooklyn N Y

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SCARCE Diamond airmail) Wonderful packet 115 different from strange countries British Colonies Haiti, Tasmania pictorials etc 5c to approval applicants Reliable Co Dept S Box 139 Church Annex New York

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GIFT Edition stamp annual free Sixty pages with hundreds of illustrations featuring Canadians Newfoundlands United States, Colonials, foreign supplies Sent free Gray Stamp Co., Dept PR, Toronto Canada

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U S Want lists filled Gigantic Bargains *Premiums Koch* Boaz Wis

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100 WALL Street Stamps 10c approvals Royce Menegray Box 693 Detroit Mich

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FOR Beautiful U S Stamps write Law 6 Endicott Ave Marblehead Mass

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TRAP Fox or Coyote Bare ground and deep snow trapping Results or no pay Q Bunch Box T Welch Minn

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BARGAINS Demonstrator Arc Welders gasoline and electric drive Liberal trial, easy terms Write Hobart Welder Ex *change Box P 31402 Troy Ohio*

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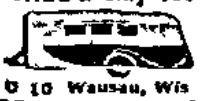
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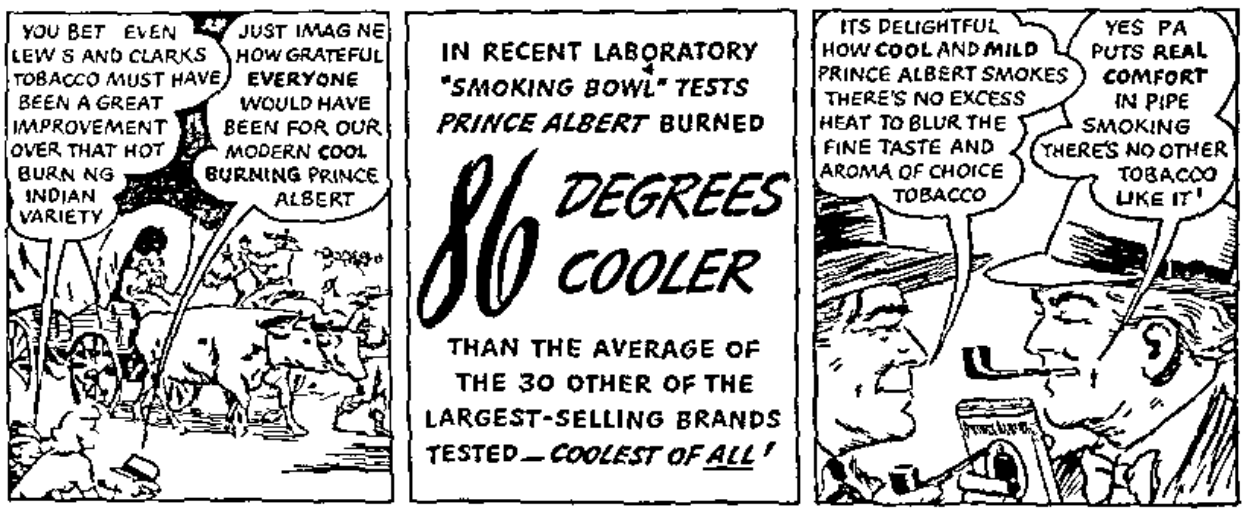
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PRINCE ALBERT

THE NATIONAL [illegible]

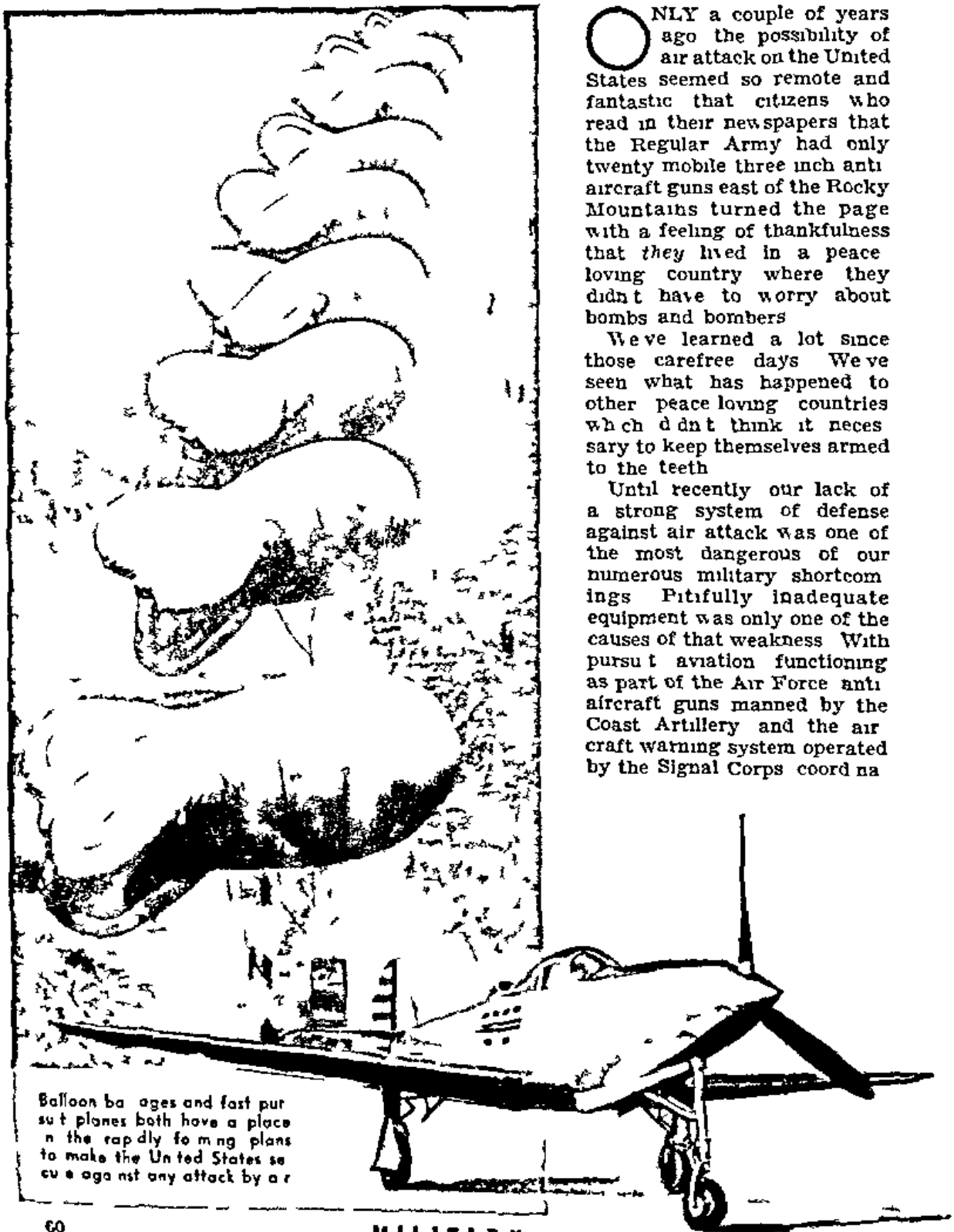


The MAN of the Month

Revolutions are nothing new to Major Edwin H Armstrong He has fathered two in the radio industry and today at fifty is watching his latest brain child F M staticless radio start a third As a motor cycle-riding sophomore at Columbia University in 1911 he jolted radio out of its crystal detector-and earphone days with his revolutionary regenerative hook up Then while eavesdropping on weak German Army stations as a Signal Corps officer during World War I he thought out the modern one-dial superhet receiver Now after more than twenty five years of endless tinkering with F(requency) M(odulation) he has eliminated static—the Bugaboo of Broadcasting Experts once said it couldn t be done but this fall F M becomes a household reality and radio s $4 000 000 000 industry feels another Armstrong revolution No swivel-chair scientist the soft spoken mild mannered major expects nothing of his assistants that he won t do himself even to dangling in a bo sun s chair to rig antennas from the tip of the 400-foot tower that tops his Alpine N J laboratory Major Armstrong hates to have his picture taken dislikes personal publicity and won t have a conventional radio in his house

BOMBERS

AMERICA FORGES NEW WEAPONS



Balloon ba ages and fast pur su t planes both have a place n the rap dly fo m ng plans to make the Un ted States se cu e aga nst any attack by a r

ONLY a couple of years ago the possibility of air attack on the United States seemed so remote and fantastic that citizens who read in their newspapers that the Regular Army had only twenty mobile three inch anti aircraft guns east of the Rocky Mountains turned the page with a feeling of thankfulness that *they* lived in a peace loving country where they didn t have to worry about bombs and bombers

We ve learned a lot since those carefree days We ve seen what has happened to other peace loving countries wh ch d dn t think it neces sary to keep themselves armed to the teeth

Until recently our lack of a strong system of defense against air attack was one of the most dangerous of our numerous military shortcom ings Pitifully inadequate equipment was only one of the causes of that weakness With pursu t aviation functioning as part of the Air Force anti aircraft guns manned by the Coast Artillery and the air craft warning system operated by the Signal Corps coord na

BEWARE!

FOR USE AGAINST AIR RAIDERS

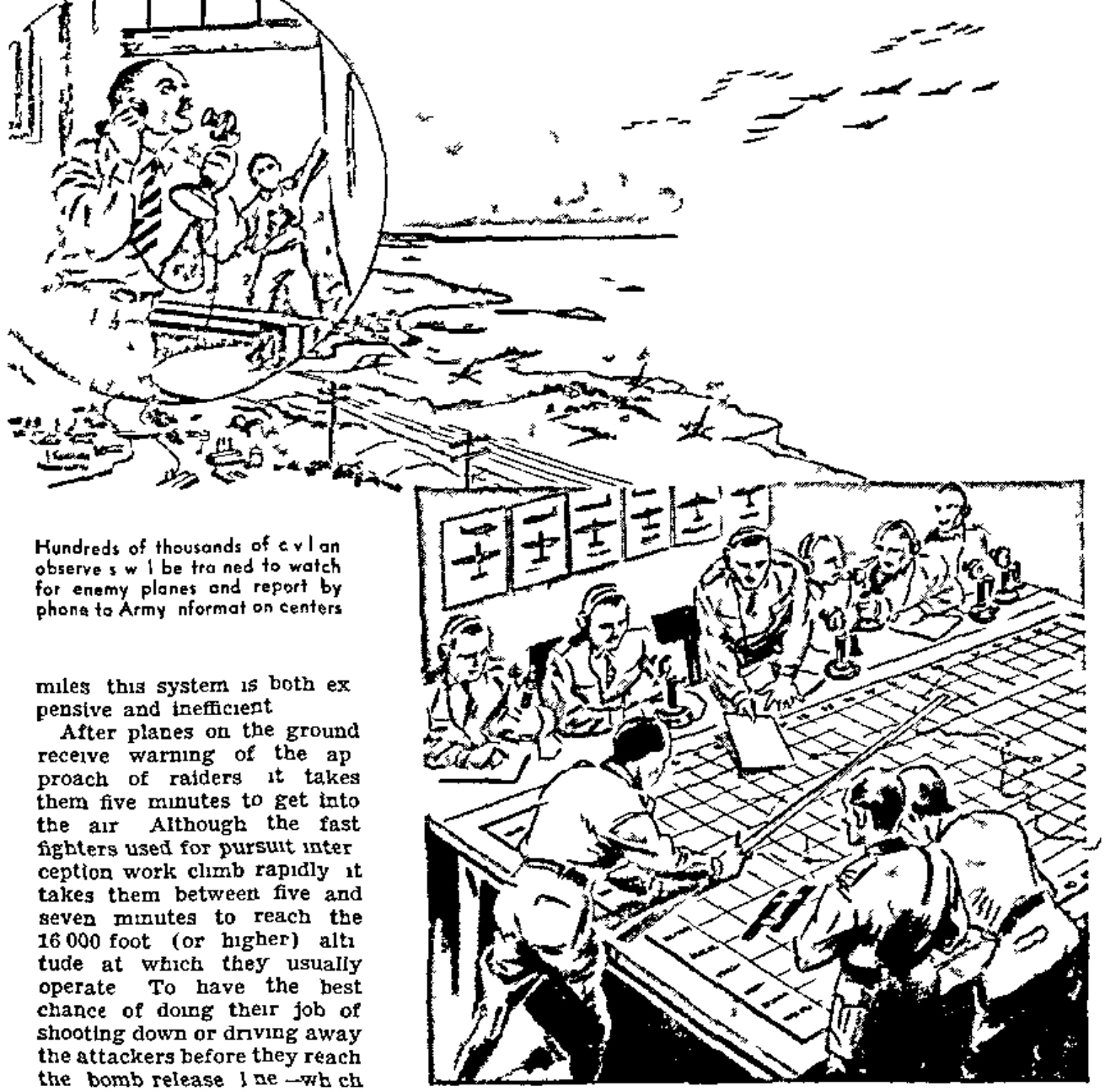
tion was impossible Early this year a long forward stride was taken by the organization of an Air Defense Command for the northeastern sec tion of the country Now for the first t me all the means and methods of air defense have been placed under the direction of a single officer—Brigad er General James E Chaney Although so far his Command has operated principally on an experi mental bas s it is expected that the methods it has developed will be adopted as a much needed nation wide air defense system

In air defense as in almost every other operation of present day war fare time is the determining factor Bombers fly about 250 m les an hour and pursuit aviat on must have warn ing of the r approach in time to get off the ground and into position to intercept them before they reach their objective

Of course the defense can save time by keeping its planes in the air instead of on the ground but because only a small part of a patrol force can be in the air at any given time and because the average of visibility from an airplane is only about five



Ant a rcraft guns w ll defend b g c t es and strateg c centers Aga nst low fly ng hedge hoppers 50 cal ber mach ne guns are deadly



Hundreds of thousands of c v l an observe s w l be tra ned to watch for enemy planes and report by phone to Army nformat on centers

miles this system is both ex pensive and inefficient

After planes on the ground receive warning of the ap proach of raiders it takes them five minutes to get into the air Although the fast fighters used for pursuit inter ception work climb rapidly it takes them between five and seven minutes to reach the 16 000 foot (or higher) alti tude at which they usually operate To have the best chance of doing their job of shooting down or driving away the attackers before they reach the bomb release l ne —wh ch for fast bombers flying at be tween 15 000 and 20 000 feet is about two miles short of the target—the fighters must have about ten minutes of combat time That means that they must fly out at least forty miles to meet the attack and that they should be warned of the approach of hostile planes while they are at least 100 miles away

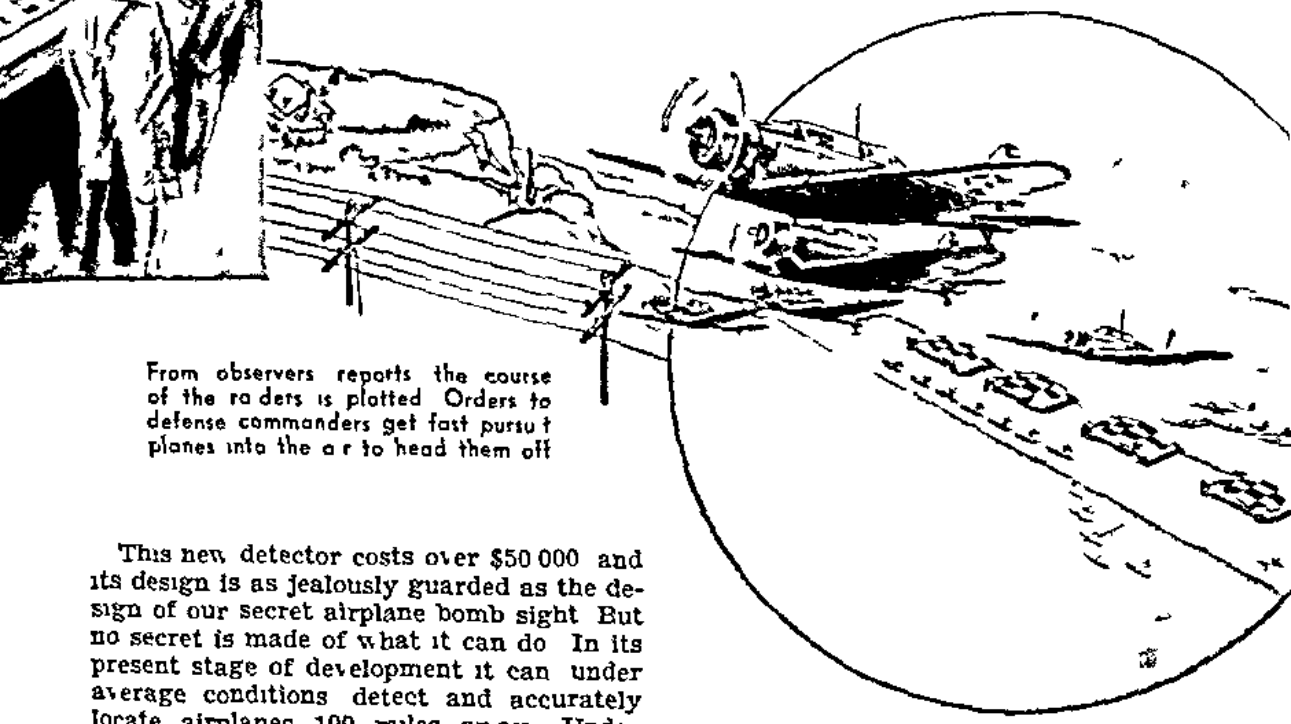
SEVERAL large scale tests have proved that an aircraft interception net com posed of volunteer civilian observers can be depended on to give timely warning of the approach of hostile airplanes to cities or other objectives located at least 100 miles from the seacoast or a land border With the cobperation of commercial telephone companies and the American Legion the Air Defense Command now is organizing such a net to cover the entire northeastern portion of the country from Duluth Minn eastward to the Maine coast and as far south as Norfolk Va Observation posts—which are the observers homes—are six or eight miles apart and as from six to eight observers are needed for each post for twenty four hour duty several hundred thousand citizens will be signed up for this patriotic service

The operation of the system is simple When an observer sees or hears airplanes he picks up his telephone says Flash and gives his phone number The central routes his call over trunk lines to the nearest Army information center A voice at the other end of the wire says Army—go ahead Using a printed message form as a guide the observer then gives the direction and approximate distance of the

planes from his post the exact time he saw or heard them and whatever information he can about their number, type, and altitude As successive reports come into the information center the positions of the planes are plotted and from these plottings their course and speed are determined This information, flashed to the officer commanding the defending pursuit aviation enables him to get his planes off the ground in time to meet the expected attack and then to keep his flyers informed by radio of the position of the attackers and the direction in which they are flying Tests have shown that the average time which elapses between the moment when an observer spots a plane and the moment its position is plotted in the information center is less than three minutes

To aid in the defense of cities fortifications and vitally important industrial areas located close to our coasts or land borders the Signal Corps has developed an aircraft detector which is far in advance of any similar instrument used by any foreign power





From observers reports the course of the raiders is plotted Orders to defense commanders get fast pursuit planes into the air to head them off

This new detector costs over $50 000 and its design is as jealously guarded as the design of our secret airplane bomb sight But no secret is made of what it can do In its present stage of development it can under average conditions detect and accurately locate airplanes 100 miles away Under very favorable conditions its range is close to 150 miles Neither clouds, fog, nor noise disturb its operation, and airplane engines can't be shielded or protected against it Some officers predict that when it has been fully developed its use may make possible deadly "blind" gunfire on unseen airplanes

One Signal Corps company equipped with this remarkable device now is attached to the Air Defense Command As soon as the necessary detectors can be built, four mobile Aircraft Warning Service companies each with equipment for five or more mobile stations, will be organized for service with our field army and if necessary, on our land borders Six permanent warning stations are to be established on the Atlantic Coast, one on the Gulf Coast, and three on the Pacific Coast and an undisclosed number in the Panama Canal Zone and in Alaska Hawaii and Puerto Rico

GETTING defending planes off the ground in good time usually means that the attackers will suffer considerable loss and damage before they reach their objective but some of them are pretty certain to get through and they must be dealt with by the antiaircraft artillery—the sky gunners who form the final protective line of air defense

No nation has and in all probability no nation ever will have, enough antiaircraft guns to provide this form of close in protection for all its cities and all its important military and industrial installations Most of our sky guns are motorized and so can be moved from place to place but it must be remembered that in a long day they can be moved about the distance that a bomber can fly in an hour

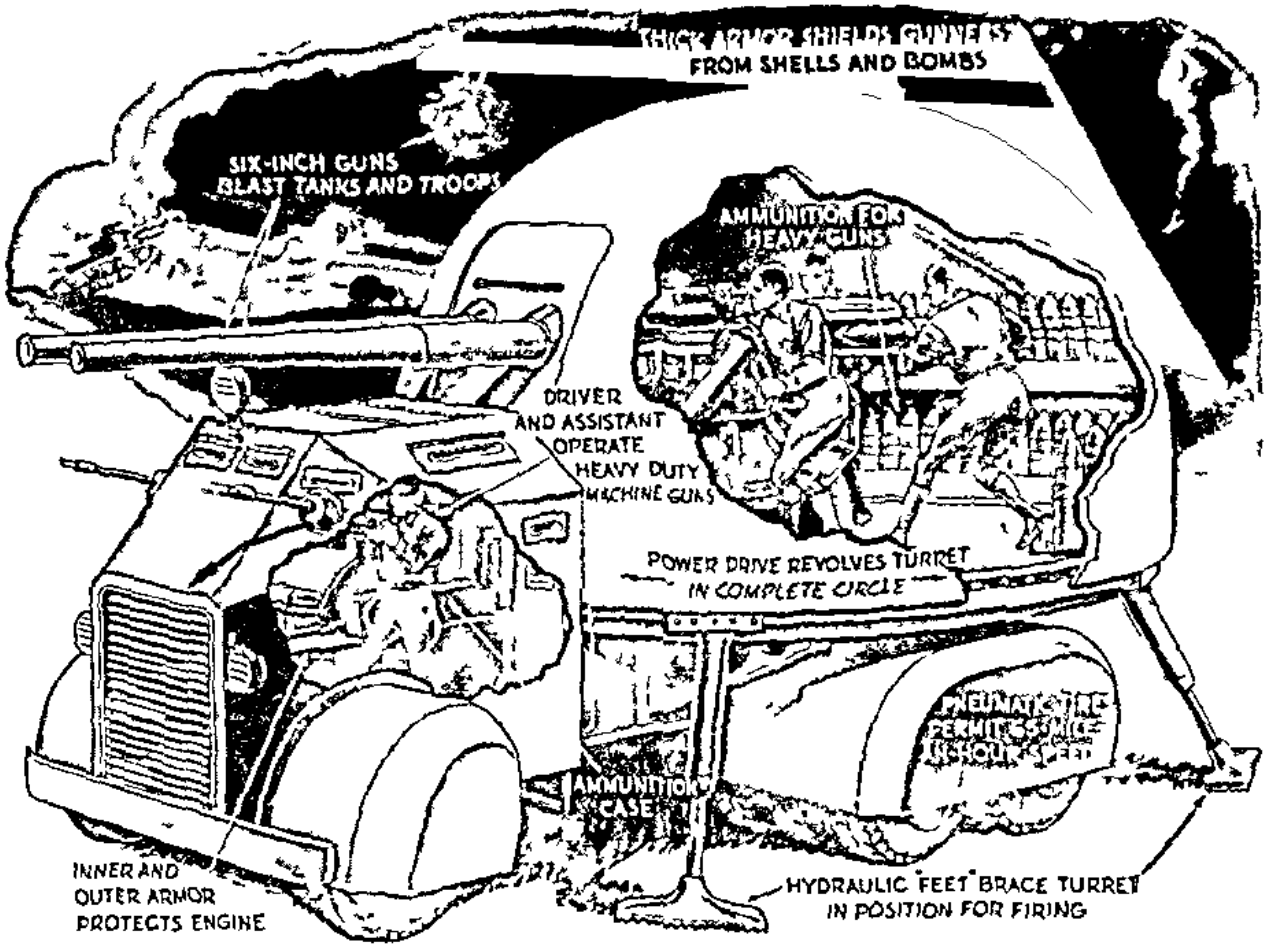
Antiaircraft artillery is a highly technical arm of our *(Continued on page 288)*

Quarry Blast Tests Shelter

SMASHING downward like a gigantic 300 000 pound hammer 150 tons of granite plunged fifty feet and crashed upon the roof of a bombproof shel ter in a spectacular test make in England The ex periment was conducted by government officials to determine the strength of a spec al granite concrete construction After the shelter had been built beneath the face of a quarry cliff drillers bored into the granite near the top of the towering wall of stone Dynam te set off in the rock tore away 150 tons of the gran te and sent it plunging down ward directly on top of the bombproof building below When the cloud of dust caused by this man made landslide had drifted aside officials rushed for ward to examine the effect It was found that the structure was intact unharmed by the mass of rock piled high on its roof

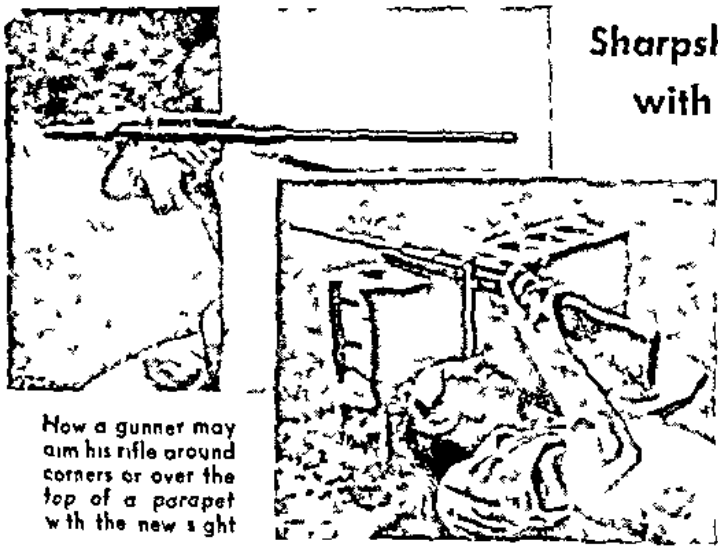


Dynam te releases a man made landsl de above a bombshe ter n a novel test As seen n the p ctu e at r ght the st uc ture rema ned ntact under the heavy load



Mobile Pill-Box Fortress Mounts Two Six-Inch Guns

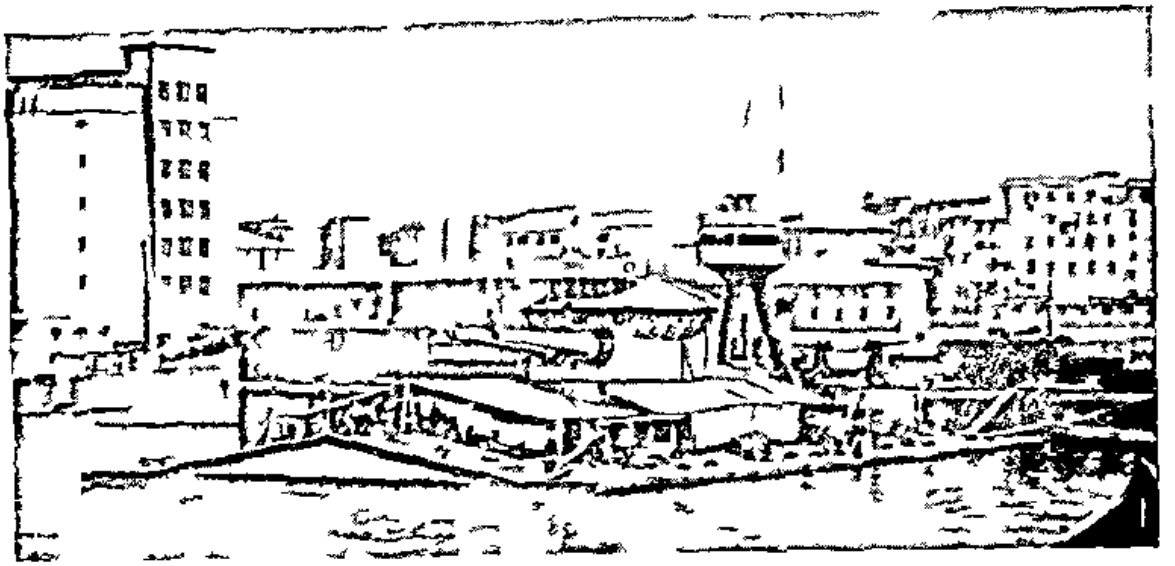
PILL BOXES on wheels, armed with twin six-inch guns in revolving turrets may prove a formidable new weapon for U S defense Racing to an unprotected area threatened with invasion, they would transform it overnight into a fortified zone whose strong points could be shifted at will to meet the changing battle picture The drawing above shows unofficially reported details of an experimental model built by a Los Angeles, Calif, truck manufacturer Subjected to four months of tests by Army engineers it is said to have attained a speed of sixty-five miles an hour



How a gunner may aim his rifle around corners or over the top of a parapet with the new sight

Sharpshooters Fire from Cover with Periscope Rifle Sight

SHARPSHOOTING acrobatics are made possible by a new L-shape periscope sight," designed to fit any standard military rifle Without exposing himself to enemy fire, an infantryman using the sight may look, aim his gun, and then fire it around a corner of a building, or over the top of a protecting parapet, without exposing himself to the fire of enemy sharpshooters The sight is being demonstrated at the left.



Floating Fortress Lies in Ambush for Enemy Shipping

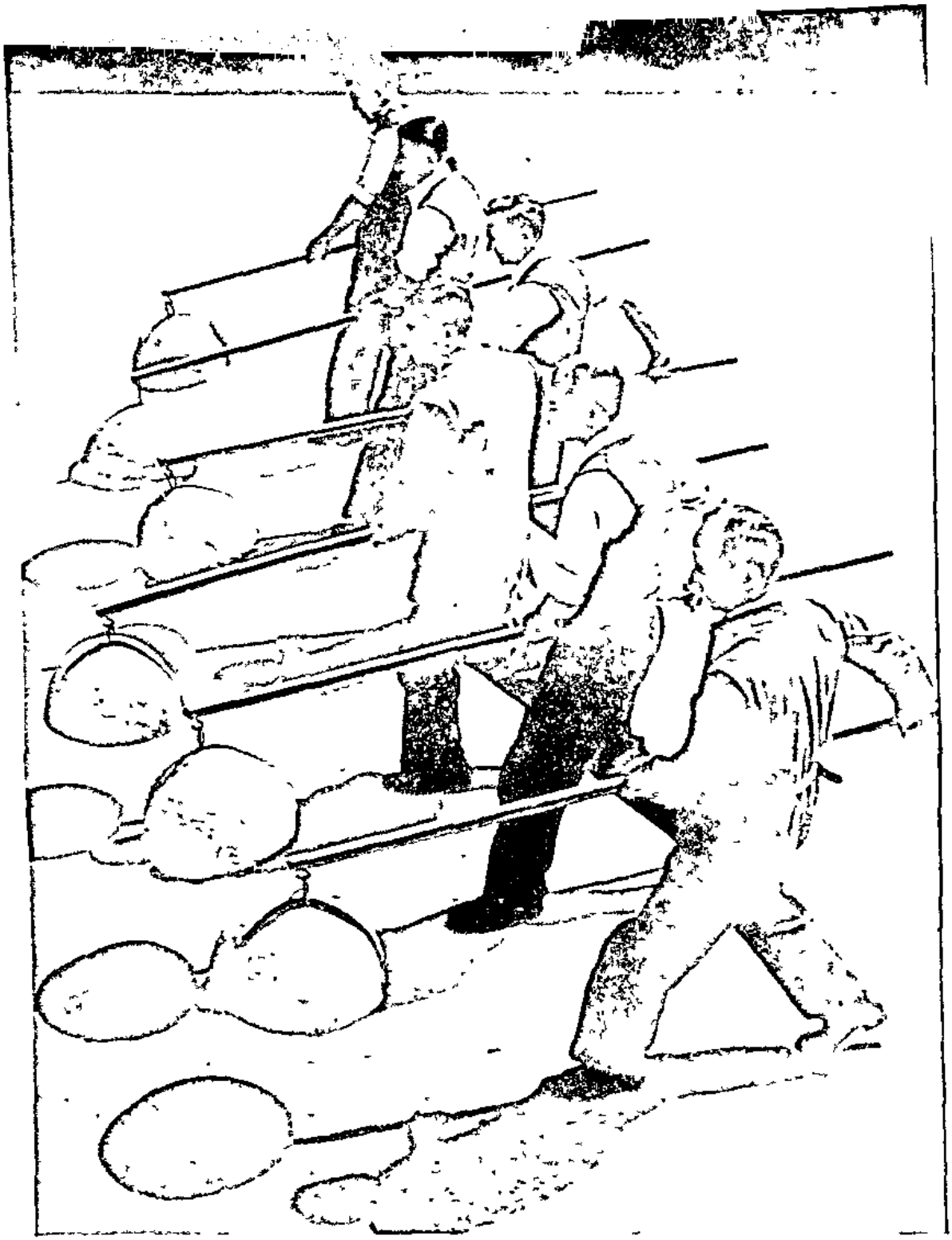
FLOAT G forts n the form of low lying armored barges fitted w th e ght nch guns represent a new type of fighting craft in the Ital an Navy The photo above snapped by an American seaman shows one of the armored rafts at Genoa Towed to sea by sh ps such mar ne forts are left n strateg c pos t ons to prey on enemy sh ps wh ch cannot s ght them unt l they are already w th n range of the r guns



F ng a bomb w h Ign te Load ng s done at low tempe atu es

Contact with the Air Sets Off New Powder for Incendiary Bombs

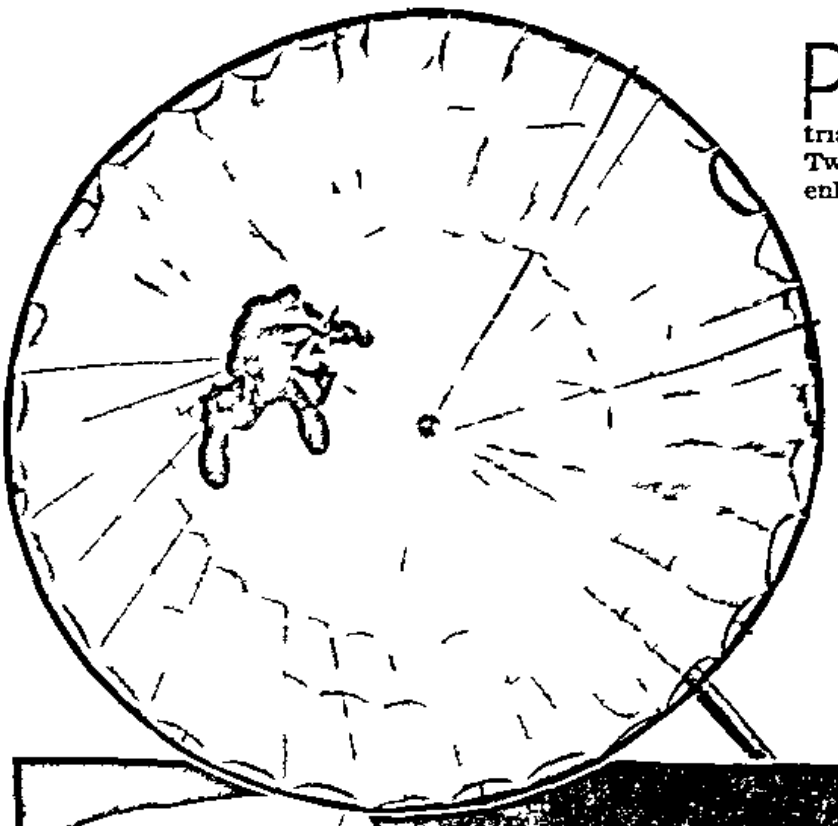
AS THE result of researches carried on in a laboratory in Melbourne Austral a Dr J R. Atcherley has announced the perfect on of a new type of ncendiary powder for use in aerial bombs The un que feature of his chem cal com binat on he reports is that except at low temperatures the powder spontaneously bursts into flame as soon as it comes in contact w th a r This elim nates the necess ty of using an elaborate fuse or other ign t ng mechanism As soon as the bomb strikes the earth and breaks its contents begin burning at a temperature of 3 000 degrees C The new ly d scovered powder called Ign te has been tested before government experts in the laboratory and further experi ments are being carried on under actual bomb ng cond tions in w hich the trial missiles are dropped at proving grounds and the resulting damage is stud ed.



Odd Snuffers Smother Incendiary Bombs

SNUFFERS for incendiary bombs are among the latest inventions for air-raid defense. Shaped like inverted bowls, and formed of asbestos sprayed over a wire-mesh foundation, the snuffers are attached to the ends of long poles by means of easily disengaged hooks. Dropped over blazing fragments, the asbestos bowls are designed to snuff out the blazing chemicals and prevent the spread of the fire.

UNCLE SAM DRILLS



PARACHUTE troops for the U S Army have just had their first mass trial at H ghtstown, N J Two officers and forty e ght enlisted men, chosen from volunteers at Fort Ben ning Ga. recently formed an experimental platoon to test large scale tra n ng methods If War Department of ficials pronounce the innovat on practical the fifty pioneers may become the nucleus of an expanded European style air infantry

For the in tial ex periment Army men used a pair of 125-foot parachute jumping towers operated at Hightstown by a civil ian concern. Mil tary



Ame ican doughboys d op f om the sky at H ghtstown N J Th s man s sp'll ng the a r f om h s chute afte a leap f om the 125 foot t a n ng tower At top another s be ng ho sted to the top for a jump

PARACHUTE TROOPS

technique developed here gradually accustoms a novice to the feel of a real parachute drop in complete safety

A learner first drops in a permanently opened parachute guided by wires as at amusement parks Instead of sitting in a swing however he wears a standard harness and is taught how to absorb the shock of landing on his feet

With the parachute still open but without the guide wires the jumper next tries free drops For this purpose the parachute launching boom can be rotated according to wind direction so that he always will drift away from the tower An instructor shows him how to spill the air from his chute as soon as he lands so as not to be dragged along the ground by a breeze

Finally the student bails out with a folded chute pulling a rip cord to open it as he would do in actual warfare If he delays overlong a safety cable brings him to a stop without injury

By these easy stages it is proposed large bodies of U S Army infantry could quickly be turned into experienced chutists Successful European tactics suggest that they would be dropped behind enemy lines to capture and hold key positions until reenforced by air or land

It is interesting to note that the United States Army was among the first to experiment with the use of parachute troops conducting tests at Brooks Field San Antonio Tex as reported in the February 1929 issue of POPULAR SCIENCE MONTHLY



Beginning a free drop with the chute open
To keep the jumper from being blown against the tower the boom is tuned with the wind
At left a student has his harness adjusted

What Are the Facts About FM?

A few years ago prominent radio eng neers proved by mathematical and other means that the periodic banging and crackling of static in your loudspeaker could never really be eliminated They were wrong For the devel opment of a system of radio broadcast ng known as FM (frequency modulation) has not only con quered the static bugaboo but has g ven birth to other innovat ons that may well cause a revo lution in America s $4 000 000 000 radio industry

What are the facts about FM? This article answers the quest ons most frequently asked



By E. W. MURTFELDT

◆ *First of all, just what is FM?* Frequency modulation, generally shortened to the initials FM, is a new type of radio communication that is static-free and almost unbelievably lifelike in tone

◆ *What is the name for the present system of broadcasting?* Amplitude modulation or AM

◆ *Who developed FM?* Major Edwin H Armstrong (see page 59)

◆ *Are FM programs being broadcast at the present time?* Yes from a number of transmitters operating under experimental licenses most of them in the East and the Mid-West You may not be able to get FM programs in your locality at the present time but every month new FM stations are springing up in all parts of the country Broadcasting of FM programs on a commercial basis is scheduled to start early next year, according to present plans

◆ *Can I hear FM programs on my present set?* No To hear FM programs you must have a special FM receiver

◆ *What wave lengths does FM use?* FM has been assigned a band in the ultra-high frequency range extending from 42 000 to 50 000 kilocycles That wave length is far below the regular broadcasting stations you hear at the bottom of your radio dial

◆ *Will the introduction of FM make my present radio obsolete?* No Your favorite programs will continue to be broadcast by the existing AM method for some time to come Your present set won t be able to pick up the programs broadcast solely by FM transmitters but FM s proponents expect that the major radio shows will soon be broadcast by both FM and AM simultaneously Possibly both types of broadcasting will continue to exist side by side But if FM ever entirely replaces AM a good many years will have passed and you will be in the market for a new set anyway, as your present receiver will be obsolete

◆ *Do all the experts believe that FM is so superior that it will eventually knock AM completely out of the picture?* No Some think that AM is plenty good enough as it is Others feel that improvements in AM methods could approximate FM s tone—and anyway, they argue, you don t need super-high fidelity to enjoy Amos 'n' Andy Because FM s range is comparatively small (fifty to 100 miles), many more stations will be required, and the problems of a coast-to coast FM network are many But FM supporters see advantages in many of the points that FM opponents list as drawbacks

◆ *Are FM receivers on the market now?* Yes

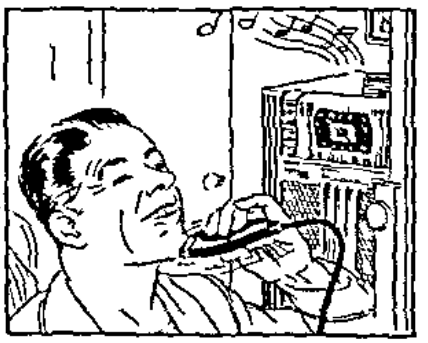
◆ *How much do they cost?* From about $600 for the most elaborate type down to around fifty dollars



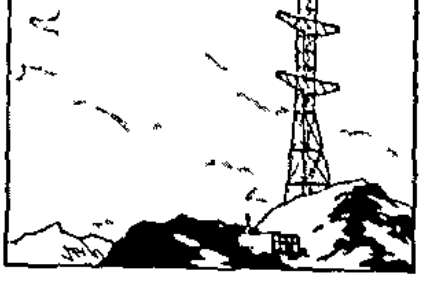
Frequency modulation was developed by Major E. H Armstrong (page 59)



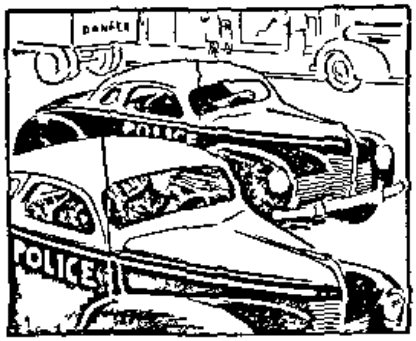
Even in the midst of a severe lightning storm programs broadcast by the new system are received distinctly



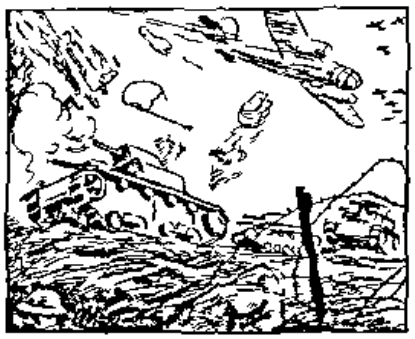
Man made static too is licked by FM You can use your electric razor and listen to the radio at the same time



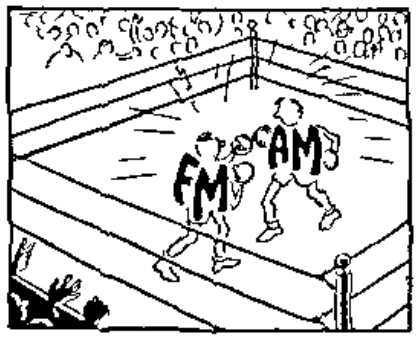
Because height gives wider range to FM signals there may be a scramble for mountain top station locations



Tests have shown that FM has great advantages in police work It also is likely to find wide use in aviation



and in warfare especially for tanks and planes The U S Army and Navy have been experimenting with it



Amplitude modulation the common system of broadcasting will have some keen competition from its new rival

for a small set This smaller unit can be hooked up to your present radio so that you can enjoy both AM and FM programs from your present loudspeaker Most of the new FM sets will receive AM programs as well Most manufacturers expect the price to come down as FM set sales volume rises

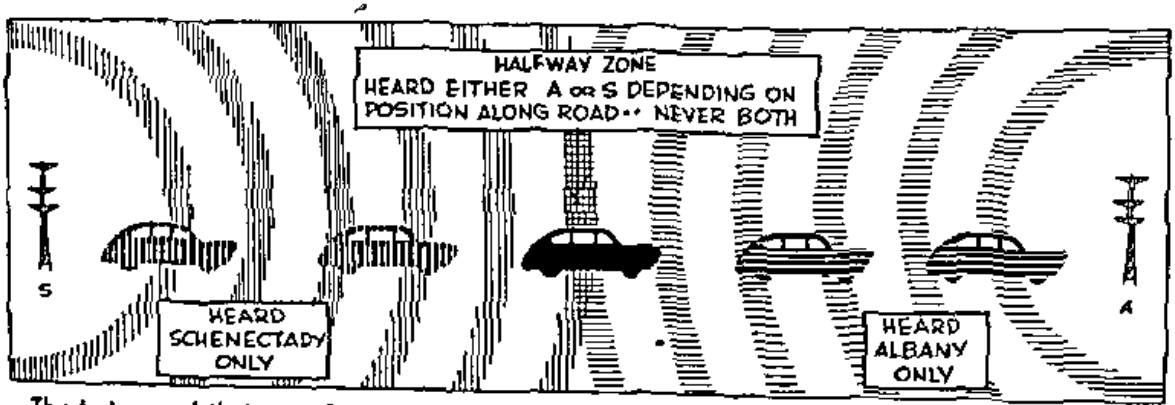
◆ *Don't you hear any static with FM?* Well, General Electric engineers recently placed a radio cabinet housing both an AM and an FM receiver in the laboratory where they create million-volt artificial lightning storms They tuned the AM set to WABC, in New York City, and the FM set to W2XMN, Major Armstrong's experimental transmitter at Alpine, N J which was rebroadcasting WABC programs by frequency modulation With the man made lightning snapping only a few feet away they turned the AM set on and heard nothing but a bedlam of static from the loudspeaker Then they switched to the new FM receiver The program came through with almost perfect clarity with nothing but a slight undertone of static buzz, too faint to mar the program (Page 70)

◆ *That sounds convincing, but suppose I tuned in an FM set during a real lightning storm Would I hear the program clearly and without static?* Yes

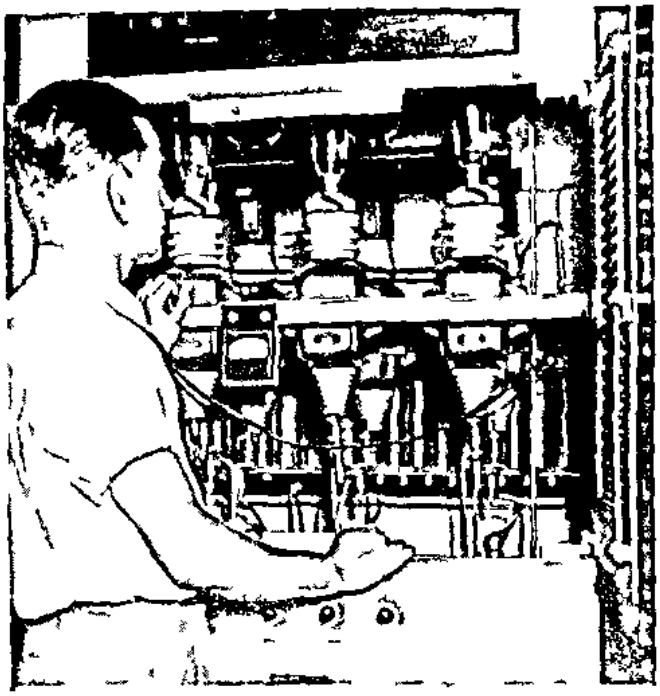
◆ *Well, suppose I sat next to an FM set and shaved with an electric razor Wouldn't the man made static caused by the razor motor be reproduced in the loudspeaker?* No And the same holds true for oil-burner motors diathermy machines vacuum cleaners, and all the other common static makers

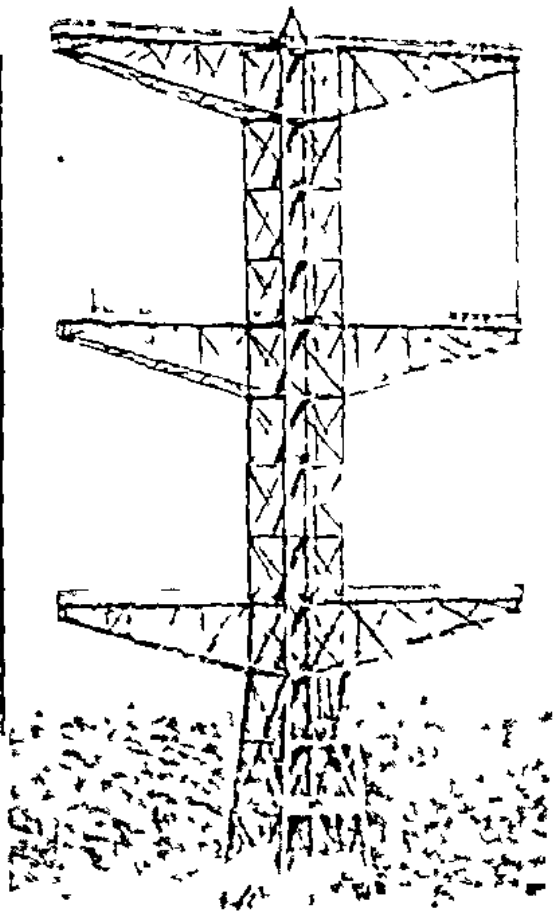
◆ *How about the tone of an FM radio? Is it really better than an AM set?* Yes FM is astoundingly lifelike Two comedians carrying on a dialogue sound as though they were hidden just behind your loudspeaker grille Symphony music is so clear and brilliant that you can practically pick out each instrument For FM reproduces a far greater range of audible frequencies than present methods Extremely high and low tones that are now lost, are reproduced by FM with near perfect fidelity.

◆ *How about interference, squealing, and fading caused by two stations on the same or near by wave lengths? Does FM eliminate* (Continued on page 237)

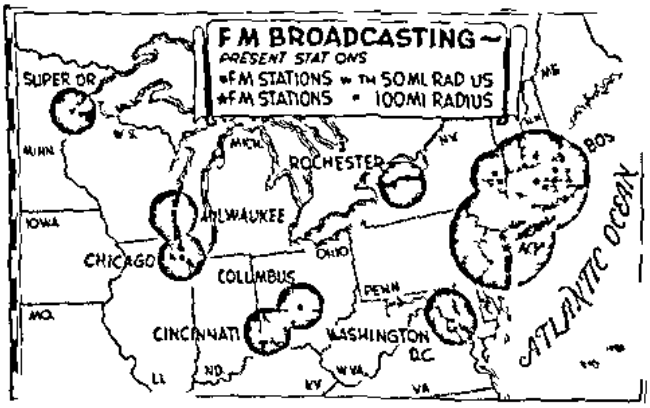


This test proved that even if two FM stations use the same wave length you never hear both at once

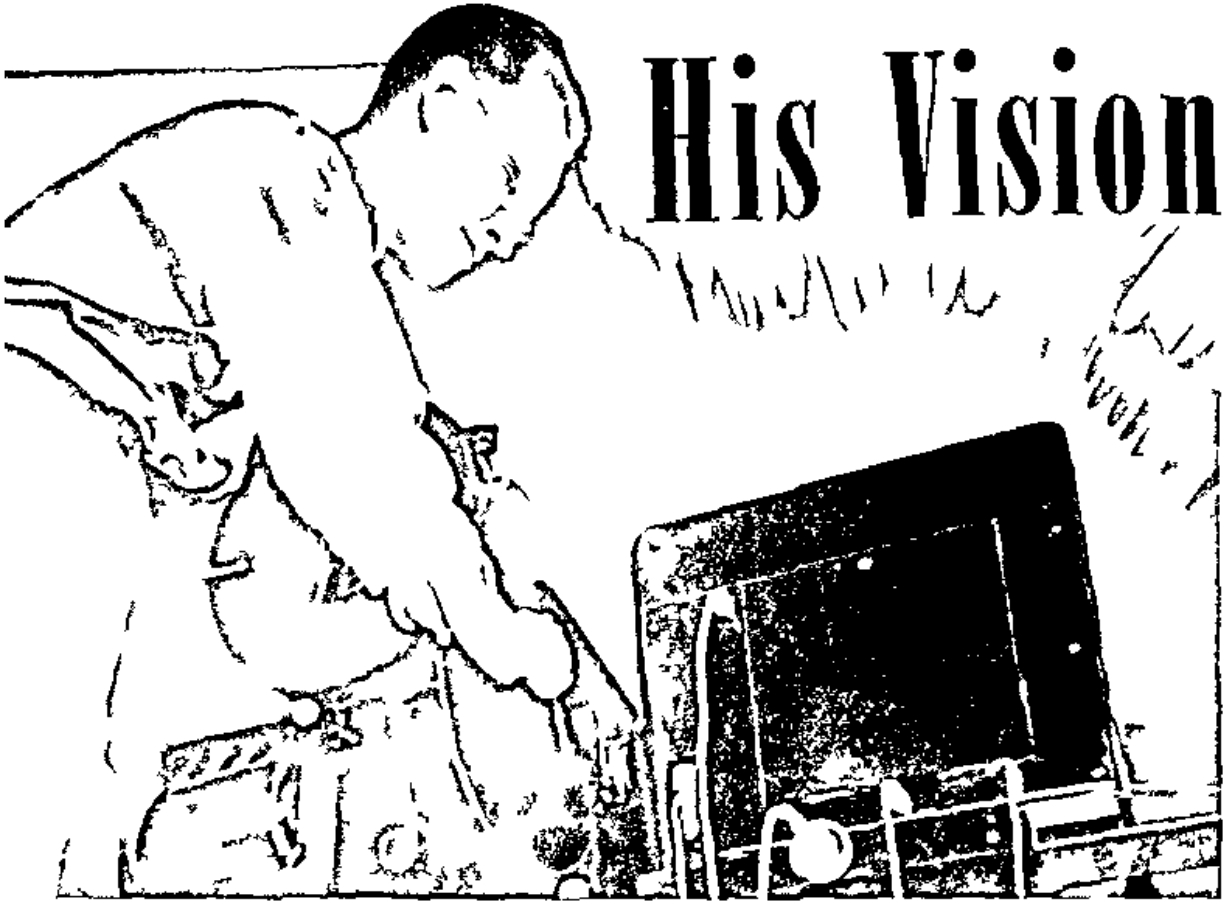




A rectifier unit in the Armstrong experimental station at *Alpine, N. J., seen with its 400-foot antenna tower in the* large photograph Map below shows the pioneer FM experimental broadcasting stations More are being built



His Vision



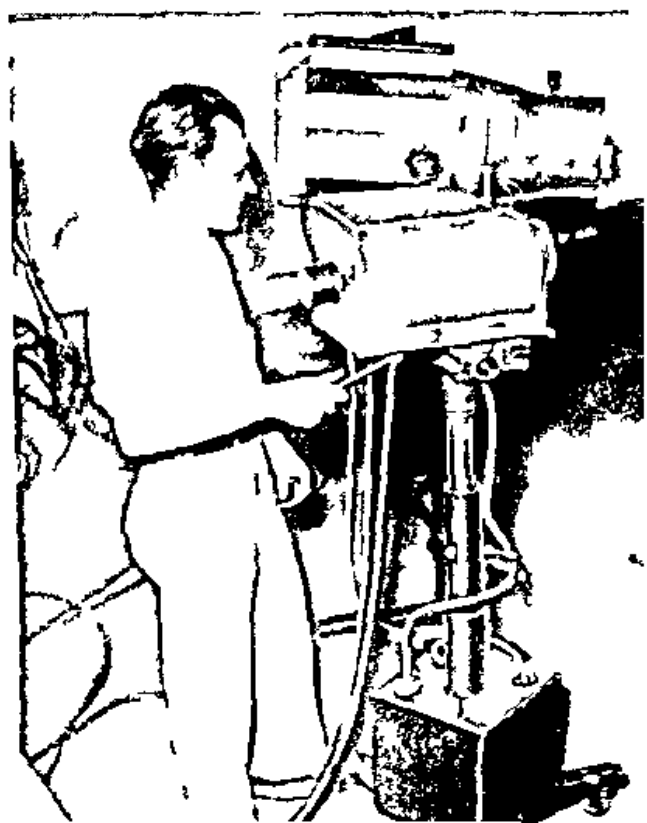
The True Story of a Boy Who Had a Big Idea and Followed It Through to Final Success

By ELLIOTT ARNOLD

THE only trouble with Philo T Farnsworth's story is that it is out of time It belongs to another day It ought to be a hoary legend now and it's just twenty years old and still in the making It has everything the school teachers love boyhood on a farm the dreamy inventor the years of struggle success It's the story of television and it all took place when folks whose names slip the mind for the moment did a lot of shouting about the frontiers being gone

Farnsworth dreamed of television without moving parts when he was thirteen a year later still in high school he invented some of the basic parts of electronic television In 1927 when he was twenty he took out his first patent on an entire television system—not just one part—and Donald K. Lippincott the radio engineer called him one of the ten greatest mathematical wizards of the day

Today at thirty three Farnsworth is vice president and general director of research of the Farnsworth Television & Radio Corp Such organizations as American Telephone & Telegraph Radio Corporation and Philco have taken out licenses under Farnsworth patents Foreign licensees include Baird Television Ltd. of England Fernseh



Philo T Farnsworth tanning a television eye on a dance team Above he is seen at work in his Fort Wayne laboratory

Made Television

Aktiengesellchaft of Berlin and T C Reth ers of Australia

The story of Farnsworth a painfully shy man starts with his grandfather the first Philo Taylor Farnsworth who established the Mormon community of Beaver City in Utah under instructions of Brigham Young

Philo s father settled a farm there and Philo grew up on it. When he was six he played con stantly not with wagons or tin soldiers but with a toy dynamo and a tiny electric motor One day he rigged the dynamo to the wheel of his moth er s sewing machine generating enough elec tricity while she sewed to operate the motor His mother hoped he would let it stay that way for a while but the boy s interest was too feverish He took the motor apart and put it together again

When he was twelve the family moved by wagon train to Rigby Idaho and worked a ranch in the Snake River Valley The place was the answer to a young inventor s pray er It was littered with equipment includ ing a private light and power system power operated hay hoists and harvesting devices that worked electrically



The inventor watches the screen of an ex per mental rece ver

The mechanical and electrical gadgets were total mysteries to all except Philo who went for them with a wild shout of glee He took every thing apart and put it together again He arrogated to himself the sole right to keep the equipment in re pair and it was no contested position since no one else could do more than push the right button

He had the equip ment working so smoothly it got to be no fun at all His family swears he de liberately put parts of it out of commission when things got dull just so he could take them apart and fix it.

His folks had been hoping maybe he would be an artist and optimistically had been feeding him violin lessons He turned out to be a pretty good player but it never became more than a relaxation He is a good violin player today and is an ex pert pianist

When his folks got wise to the planned vandalism of the machinery on the farm they thought they would put an end to it They gave him a new chore to keep him out of mischief—operation of the gigantic fam ily washing machine But they didn t know their son Farnsworth became fed up with moving the handle back and forth and rigged up an electric motor winding the intricate coils of the armature himself and soon had a power operated machine He was not yet thirteen



A new idea takes shape on paper Farnsworth was thirteen when he got the inspiration that has guided his work in television

Farnsworth a very modest man does not offer any of this information with the intention of trying to limn the early life of a genius

The only significant thing in all this,' he says is that it gave me a background at a very early age of the elements of electricity, and gave me an incentive to study electric physics and through the medium of popular magazines a knowledge that there was such a thing as television '

The boy read everything he could lay his hands on that dealt with television as it was being planned then, and finally he asserted to all who would listen to him, that the research experts were barking up the wrong tree trying to develop a television system by mechanical means

The major experimenters were using mechanical whirling disks to scan the image Farnsworth declared that this would get them nowhere for the simple reason that the transmission of a satisfactory image required scanning speeds greater than any whirling disk could reach and maintain

Electrons, he said moved with the speed of light itself, and they could do the job if properly harnessed and controlled That conception is the basis of today s electronic television—television with no moving parts —and it emerged from the head of a boy who hadn t yet started to shave

'I had a theme for research which continued through the years as a guiding light," he says, 'or as a direction for research and development namely, the elimination of all moving parts from television equipment.

'The idea I had fairly well established in 1921 when I was thirteen, so that the moment I discovered tools — out of textbooks I mean — which would enable television to be done without moving parts the invention seemed almost simultaneous as a matter of fact, simultaneous with the discovery that there was an electron and a photo-electric effect

'In 1922 when I was a freshman in high school, I made my first big invention in television — and it consisted of a means of producing an electric counterpart of an optical image At that time it was a daydream, a daydream only I had no facilities for doing research I had no money to buy equipment

All I had was access to a very modest school library, and my sum total of equipment for forming any definite practical idea as to the problem of television consisted of a static generator in the high school physics laboratory, and an old Braun tube '

ONE of his high-school teachers, Justin Tolman took a great interest in Farnsworth The teacher and pupil used to hold long conversations on the molecular theory of matter, the structure and nature of electrons, and Einstein s theory of relativity The teacher later said that young Farnsworth's discussion of the theory was the clearest and most concise he had ever heard

One day after school Farnsworth started to draw on the blackboard He worked for hours, correcting erasing, and then he began to explain it to his teacher It was his conception of an electronic television system

The teacher studied for a long time and then admitted it was beyond him He gave the boy the most advanced textbooks on the subject he could think of, and told him to go on with his dreams

Soon after the Farnsworth family moved to Provo, Utah, and young Farnsworth took some special courses in Brigham Young University In *(Continued on page 236)*

Courtesy New York Herald Tribune



Unshackle Him!

• When "Ding" penned this cartoon some months ago, America's great defense program was just beginning to roll. Today, industry has gone to war. Our powerful industrial giant is slipping free of his shackles and the smoke of activity is pluming from the nation's factories. To provide our readers with an authoritative background against which to project the news of the day, POPULAR SCIENCE MONTHLY *presents on the following* pages the first of a series of dramatic articles revealing just how *industry is* being mobilized to arm Uncle Sam's vast forces of defense for guarding *our country* against the danger of attack from any quarter.

Industry Goes

HOW AMERICA IS MOBILIZING THE MEN BEHIND THE MAN WITH THE GUN

AMERICAN industry is mobiliz ng its *men and machines to fill the big*gest and most important order it has ever rece ved Time to go to work wh stles that have been silent for years are blow ng again New plants are being built Government arsenals are work ing three sh fts s x days a week By next spring our manufacturing machine will have been shifted into high to turn out the *airplanes guns fighting ships* and mun tions we must have to make us safe against any form of aggress on

It took Hitlerized Germany seven years of peacet me total mobilization to get ready for the current war Never in all history had there been anything that equaled that awe inspiring national effort It was a peacetime mobilization that missed no one Industry was controlled by the placing of must orders and the allotment of raw materials and the salar es of its executives were limited by government regulation Labor which worked seventy hours a week was controlled by the outlawing of unions prohib tion against chang ing jobs without official approval and outright conscription Capital was con trolled by compulsory investment of profits in no interest government se curities or in unprofitable enterprises It was strictly an or else program Orders were backed up with threats of heavy fines economic ruin or for the really obdurate a concentration camp or even a firing squad Those seven years cost the German people their political and economic freedom and the equivalent of 40 000 000 000 American dollars but they gave the Nazis the most nightmarish war mak ing machine the world has ever seen

In an effort to assure the safety of the United States in a world which gives every indication of remaining rough tough and dangerous for a good many years to come Congress in the course of its present session has appropriated over $10 000 000 000 in the form of cash and of contract authoriza*tions for national defense*

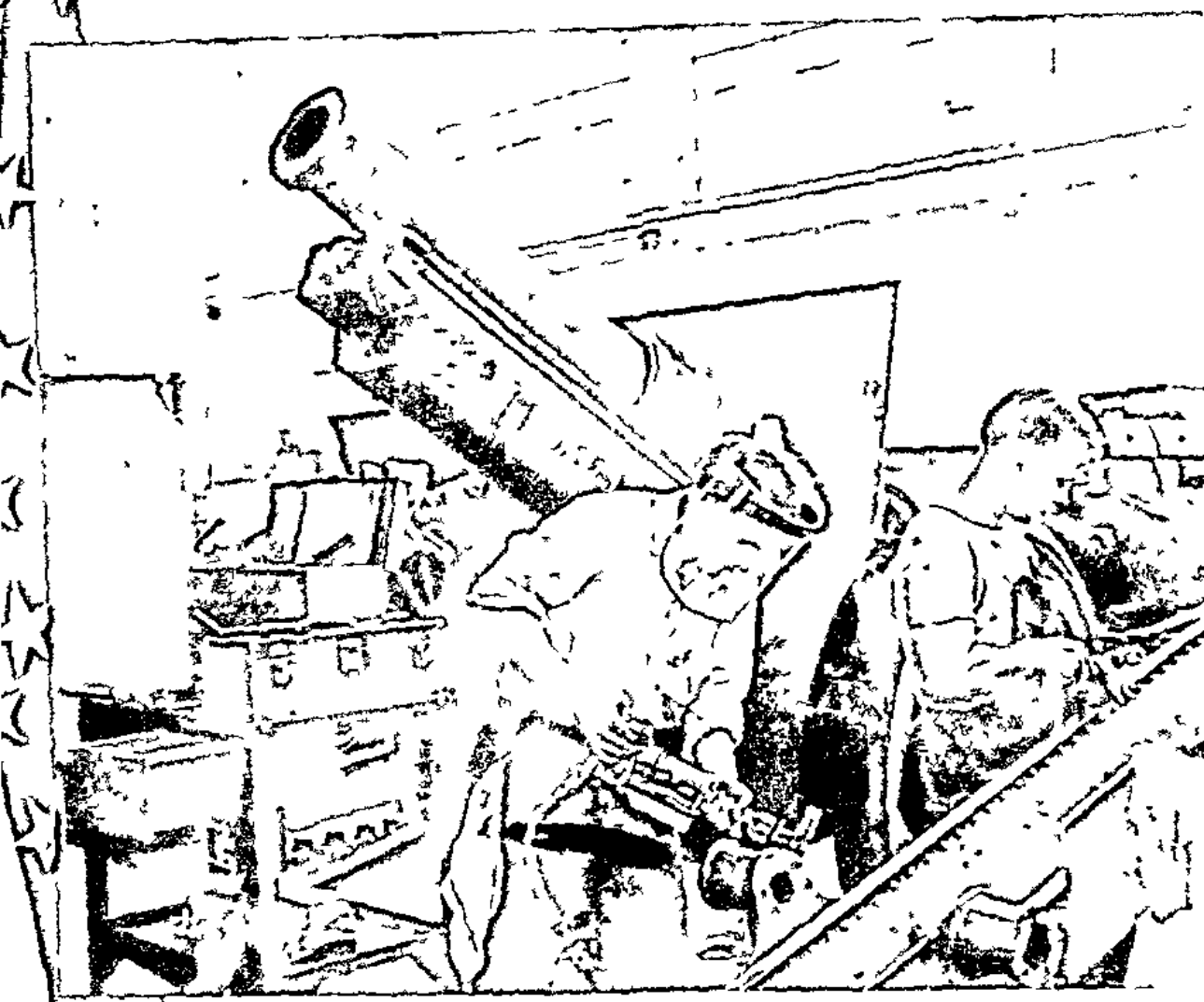
Those appropriations will be spent to order 14 394 airplanes for the Army and Navy and so make a start on a program which calls for the production of 25,000 planes a year by July 1942 to procure complete armament and equipment for a modern highly mechanized army of 1 200,000 men and the hard to get in a hurry items of armament and equipment for an additional 800 000 men to start the build ng of ap proximately 200 additional fighting ships which will give us a Navy powerful enough to control the Atlantic and the Pacific at the same time and to provide new national defense construction and manufacturing facilities including the expansion of sh p-



Play ng a march on a xylophone of war an nspector stamp ng 155 m ll meter shells

to WAR

By ARTHUR GRAHAME

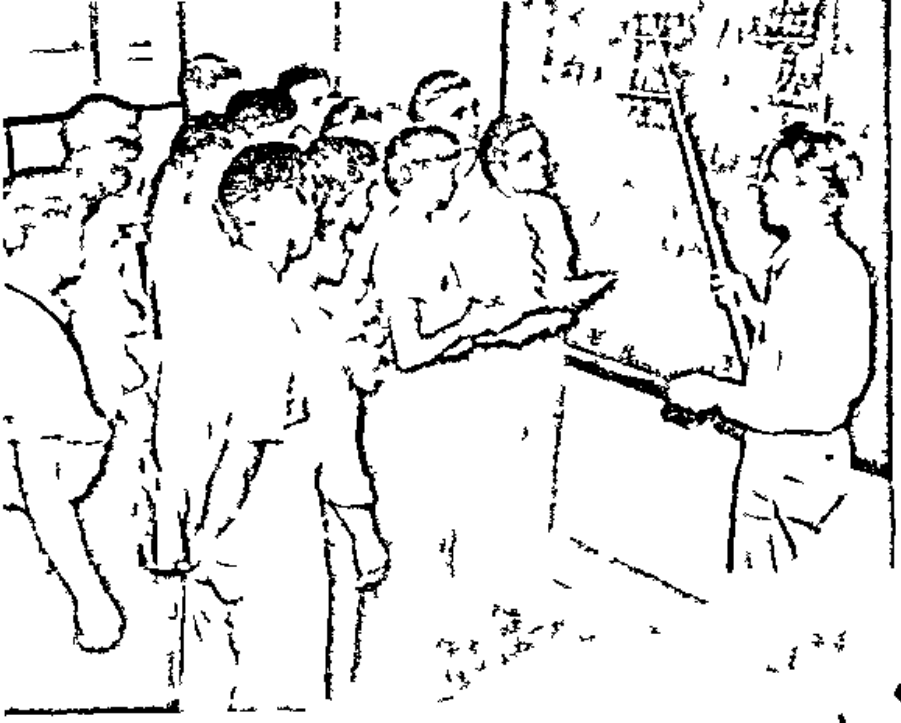


yards and the building of thirty one ordnance plants far enough away from our coasts to be beyond the range of air attack.

Congress has supplied the necessary billions. Transforming those billions into bombers and fighters, into antiaircraft cannon and field guns, into ships, tanks, motor trucks, O D uniforms, Garand rifles, undershirts, and the 70,000 or so other things the fighting services need is industry's big job.

Hitler, using the dictatorial *"entweder oder"* method of getting things done, achieved astounding results by handing Germany's industrial mobilization over to the rotund, hard-boiled, and able Marshal Hermann Goering and his economic general staff of impressively uniformed officials. Uncle Sam, sticking to our democratic *Let's go, gang!'* method of voluntary cooperation, is confident of getting equally satisfactory results by having the production end of our preparedness program guided by industrial experts who work for the Government for nothing a year and who think, act, and look very much like the thousands of other doing-all-right Americans you can see any week day on New York's lower Broadway, Chicago's LaSalle Street, Detroit's Cadillac Square, or at the Rotary Club luncheon in Springfield—Massachusetts or Illinois.

To get those experts on the job, late in May President Roosevelt used the powers



MEN FOR THE MACHINES

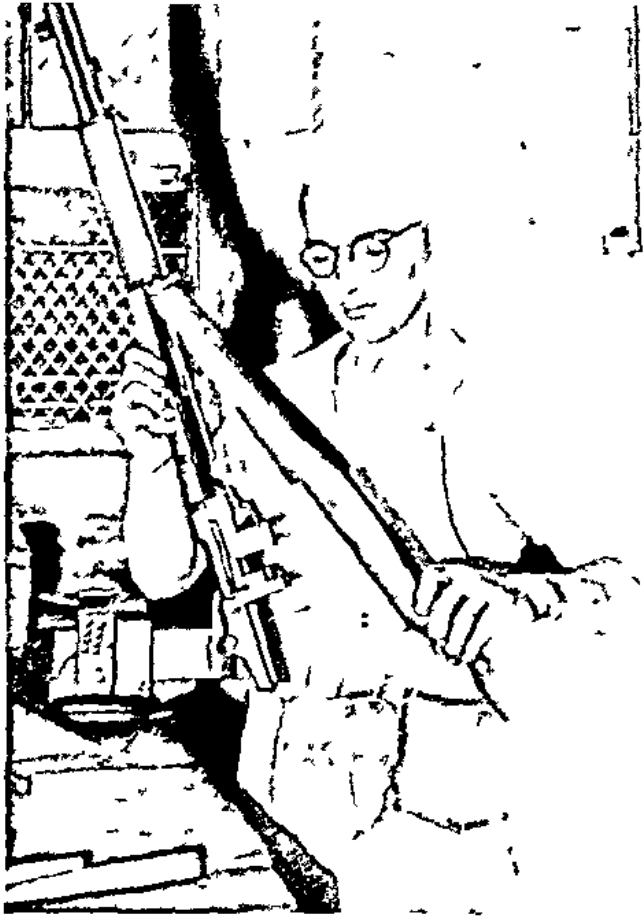
Apprent ces of a Government arsenal where workers are be ng tra ned to meet the need for sk lled man power Below a young mach n st w th h s d ploma from a course at a large factory

of the National Defense Act of 1916 to re vive the World War Advisory Commission to the Council of National Defense which had been dormant for almost twenty years The Commission acts as a coordinating agency between the Government depart ments which have to procure national de fense material for the armed services and the industries which will have to provide it.

When he made his appointments to the key positions on the National Defense Ad visory Commission President Roosevelt gave the world a convincing demonstration of the fact that the United States still is a country where the really big jobs go to men who have proved that they have what it takes to handle them

William S Knudsen automobile assembly line wizard left his big job as president of General Motors to coordinate the produc tion of defense material break bottle necks and be the Commission s all around trouble shooter Edward S Stettinius Jr re s gned his $100 000 a year position as chair man of the board of the U S Steel to become the Commission s procurer of raw materials Sid ney Hillman who is in charge of coordinating labor and of training workers for the defense in dustries has been president of the Amalgamated Clothing Workers of America ever since the or ganization of that union in 1914

The other members of the commission are Ralph Budd the president of the Chicago Bur lington and Quincy Railroad in charge of coordi nating all our transportation facilities Chester C Davis a member of the Federal Reserve Board who is responsible for accommodating agricul tural problems to the defense program Leon Henderson of the Securities and Exchange Com mission in charge of the statistical study of prices and Miss Harriet Elliott, dean of women



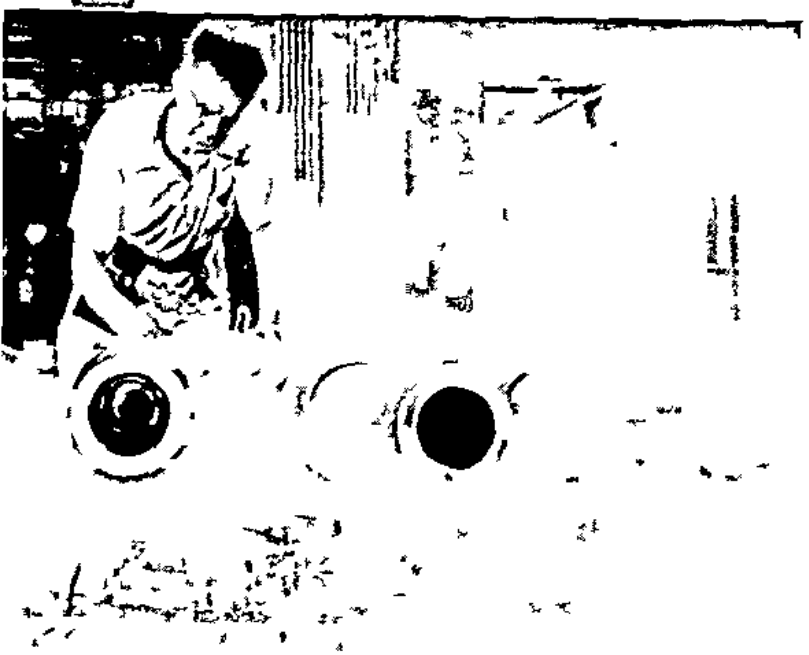
Assembling a Garand rifle at the U S Arsenal a Springfield Mass Production of this new infantr weapon was speeded up by the defense progra

of the University of North Carolina, whose duties include the protection of consumers and trying to keep down the cost of living None of the commissioners receive salaries, but the Government pays their expenses All of them are assisted by staffs of executives and expert advisers

While the Commission has no formal executive authority it reports directly to the President and under the National Defense Act the President has all the authority he needs to drive through the defense program—authority to establish priorities which would give Government orders the right of way whether or not business men liked it and authority to place compulsory orders So the Advisory Commission has iron fists although it has worn and is likely to continue to wear, velvet gloves over them in its dealings with industry

Its methods are well illustrated by its handling of the question of priorities Suppose for example, that Greene & Browne who are in the toy business decide to bring out a new design kiddie car and place their order for the machine tools necessary to manufacture it. A week or two later Black & White sign a contract to make—let s say —antitank gun parts They must have specially designed machine tools to make them and they can t get those tools in a hurry because Greene & Browne got their order in first Black & White go to the Advisory Commission with their troubles Antitank guns being, in the present unhappy state of world affairs considerably more essential to the nation s welfare than kiddie cars, the Commission could ask the President to paste a priority label on Black & White's order, and Greene & Browne would have to wait and whistle for their tools But the Commission doesn t do that Instead, one of its representatives calls on Greene & Browne and explains the situation Greene and Browne go into a huddle and, being patriotic citizens, come out of it with an offer to hold over their new kiddie car until next year so that Black & White can get those antitank-gun parts into production

The Commission calls that the preference, or voluntary priority, system of procurement, and up to date it has worked so well that there has been no need to enforce legal priorities in order to get results



After reconditioning these 75-millimeter field gun barrels will be mounted on new high speed carriages

The way in which Ralph Budd, the Commission's transportation coördinator, deals with the railroads provides another example of the 'Let's go, gang'' method of getting things done without fuss or bad feeling Noticing that on June 1 there were almost 164,000 box and open-top cars—slightly over ten percent of the railroads' freight-carrying rolling stock—awaiting repairs and anticipating heavy

defense-industry traffic this fall, he wrote (as one railroader to another) to the president of the Association of American Railroads suggesting that to make sure that they would be able to do their part of the defense job the lines should reduce the proportion of bad orders to less than six percent by October 1. The October figures aren't available yet but it's a dollars-to-doughnuts bet that when they are released they will show that the number of cars needing repairs has been reduced below the requested figure.

ITS ability to make good use of the personal approach is one of the Advisory Commission's biggest assets. The automobile manufacturer who gets a letter from it asking him to go into the making of airplane cannon knows that it didn't come from some War Department brass hat but from Big Bill Knudsen, the fellow who knows all about assembly lines. The union official who is asked to solve the labor problems of a shell-making plant knows that he isn't dealing with some office-holding theorist but with Sid Hillman, a veteran labor man. Gaudy uniforms and high sounding titles may impress people in some countries but American business men like to do business with men who wear the same sort of clothes they do and who speak their language. That's one of the reasons why, even if some day we should get into a big war, our industrial effort will be guided by *civilians*.

One of the reasons for bringing Knudsen to Washington was that he is a famous *breaker* of production bottlenecks. The first bottleneck he attempted to break on his new job was in the machine tool industry. Machine tools are necessary for the production of every weapon from a .30 caliber rifle to a sixteen-inch harbor defense gun. Shells can't be made without turning lathes and the armor plate for a battleship can't be worked without huge planers and *millers*. A serious shortage of machine tools would block our defense campaign before it ever got started.

The firms in the industry offered the Government 100 percent cooperation, individually and through the National Machine Tool Builders Association. They already had cracked one of their own potential bottlenecks by starting to train workers both in their plants and in cooperation with vocational schools. Priorities weren't necessary. All that was needed was to tell the tool makers what the Government wanted first. They put their facilities as completely at the nation's service as if war had been declared. They cooperated with the Commission's and the Army Ordnance Department's experts in designing a machine which doubles the production of rifle barrels and in the development of a simple single-purpose lathe which can, if necessary, be operated by a woman and which can be produced by others than expert machine-tool makers. The work of the tool-making industry hasn't been spectacular, and some of it of necessity has been slow, but it has been highly effective.

Many people have feared that a shortage of some critical raw material might seriously handicap our rearmament. That is possible, but the danger seems remote. We have nearly all of the materials we need, and have them in quantities which are practically inexhaustible. For some years Government agencies have been building up stock piles of materials which we can't produce and which we might have trouble in getting in an emergency. Just how large those stock piles have grown no one outside the Government knows, but it is no secret that since Stettinius was appointed to the National Defense Advisory Commission's procurement job he and his staff have displayed very considerable ingenuity in adding to them.

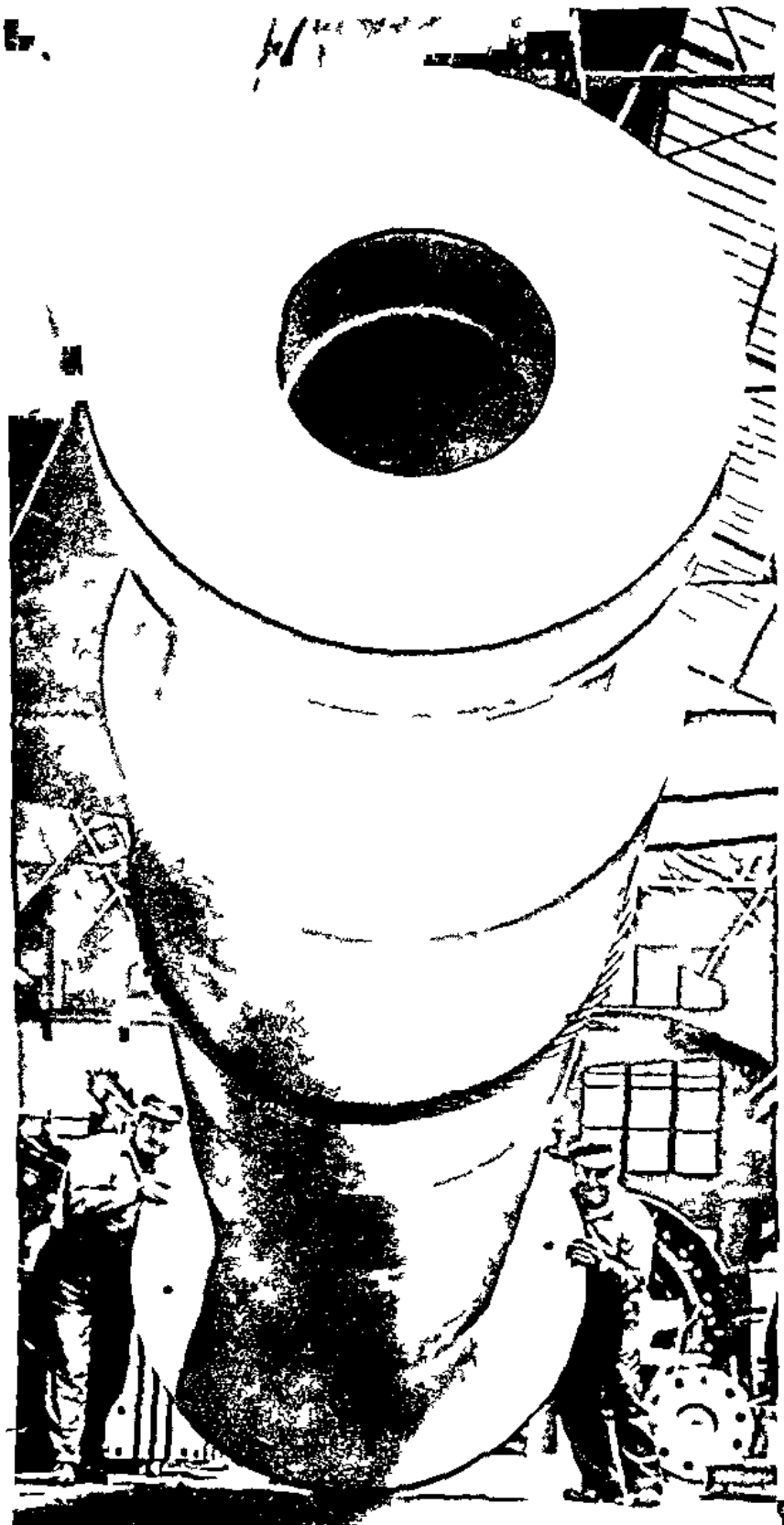
Most of our rubber comes from the Malay Peninsula and the East Indies, and our supply might be cut off if Japan went on the warpath against us. That would have been fatal twenty years ago, but it is much less serious today. Several American manufacturers are ready to undertake the large-scale production of synthetic rubber made from petroleum.

Ordinary gasoline, the lifeblood of mechanized warfare, presents no problem. Our supply of 100 octane gas of which our expanded air forces will use tremendous quantities is being conserved by means of an embargo, and adequate reserves are being stored in safe places.

The chemical industry is cooperating whole-heartedly in the national effort, even to the extent of its members exchanging closely guarded secret formulas with their competitors'.

EVERY bit as vital to our national defense as the man with the gun are the men behind the man with the gun. The number of workers necessary to arm and equip each soldier and keep him supplied with the food ammunition clothing and all the other things he needs in war have increased in proportion with the increased *mechanization* of warfare. In the World War we needed six workers for every soldier. At the outbreak of the present war German military authorities estimated that they were going to need eighteen workers for each soldier!

Rearmament is different from war because it doesn't have to make good the in-



INDUSTRY S BIG GUN The s xty f ve ton shaft of a 75 000 ho sepower generator to be installed at Bonnev lle Dam n O egon The powe it turns out w ll help to make our country safe from Fgg ess on

credible loss and waste of war so we won t need so high a ratio of men in overalls to men in uni forms Industrialists figure that during the coming year our defense program won t demand more than a tenth of our industrial productiveness

After investigating our probable manpower needs Sidney Hillman says that the reservoir of our 5 500 000 unemployed workers will take care of most of our labor problems of the near future Many of these men are unskilled but many others of them *were* skilled and the Gov ernment is giving them the opportunity to take refresher courses at W P A wages to bring back the skill they lost during their years of rust ing Large numbers of unemployed youths are being trained for the de fense trades The Gov ernment also is cooperat ing with employers in provi ding on the job train ing for employed workers who want to qualify for better jobs and in train ing apprentices The United States Employ ment Service which has over 1 500 offices will help in bringing the right worker and the right job together and in overcom ing labor shortages in in dividual trades and in par ticular localities

We have the money we have the materials we have the manufacturing facilities and we have the men What are we doing with them? Are we get ting anywhere with our rearmament job?

Perhaps our progress in increasing our air force is disappointing to optimists who expected to see those 50 000 airplanes President Roosevelt mentioned fly ing before this winter It isn t disappointing to the men in the industry who

knew the tremendous amount of make ready work which would have to be done to increase production from a few hundred planes and engines a month to 50 000 planes and 125 000 engines a year Most of the planes on order now are training planes—they are needed first Knudsen is confident that the industry in addition to filling its British contracts will be able to give us 18 000 Army and 7 000 Navy planes by July 1942 It will take at least another two years for it to reach the 50 000 a year production level

Most of the 10 340 large and small manufacturing plants—located in forty five states —which have been approved by the Army and Navy have received orders and are working on them

AMERICAN industry is literally beating plowshares into swords Manufacturers of agricultural implements are producing gun carriages and combat wagons producers of lathes for making wooden shooting gallery ducks are turning out lathes for army shoes church pipe organ makers supply wooden frameworks for military saddles Makers of printing presses are producing the recoil mechanisms for 155 millimeter howitzers manufacturers of vacuum cleaners are making gas masks and specialists in adding machines are turning out shell fuses Factories that formerly created toy soldiers and miniature trains are developing gears and canteens troops in the field will sleep under mosquito netting furnished by firms that make ladies underwear

Weapons are rolling off the production lines in Government arsenals and privately owned factories The Springfield Arsenal is making 1 560 Garand rifles a week two years ago its production was 150 a week. One manufacturing plant is turning out an average of six light tanks a day

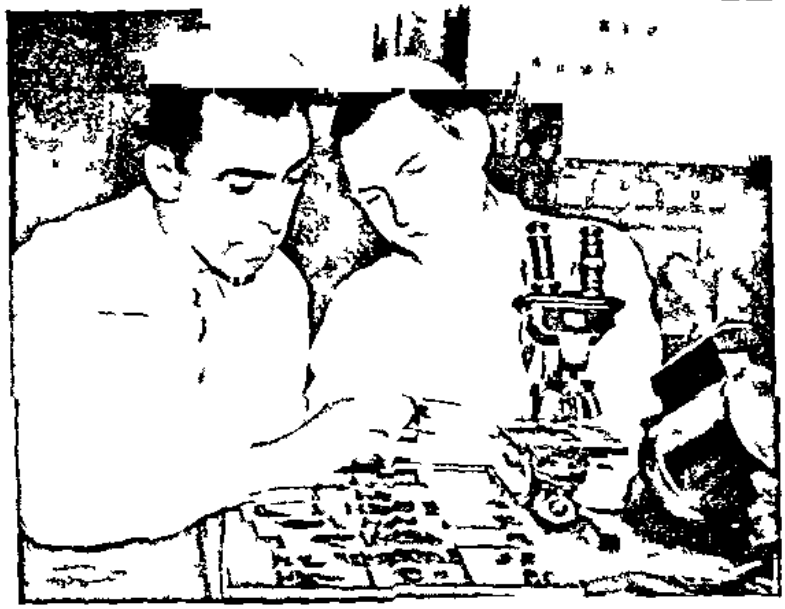
Work has been started on a Government owned Du Pont operated powder plant at Charlestown Ind Next spring it will start producing 20 000 pounds of powder a day In 1917 the contract for our first powder plant wasn t signed until after we had been at war for seven months A seamless tubing manufacturer in Pennsylvania is making steady deliveries on a $25 000 000 airplane bomb order

Within the next month or so the Quartermaster Corps will take delivery of 5 000 000 yards of serge which will make 1 500 000 O D uniforms 4 000 000 yards of heavy woolen cloth which will make 1 000 000 overcoats and 1 500 000 yards of worsted shirting which will make almost 1 000 000 shirts for fighting men

Work is being rushed on the Navy s combat ships now under construction As soon as they are off the ways their places will be taken by other new fighters The expansion of shipbuilding facilities soon will be started to take care of both naval and merchant ship construction

From coast to coast the roar and clatter of machinery and black smoke belching from factory chimneys are telling the world that if any emergency arises America will not be caught unprepared'





Drs Bodian and Howe studying microscope slides in paralysis tests

Tests on Monkeys Give New Clew to Infantile Paralysis

BECAUSE infantile paralysis leaves a pattern of inflamed tissue along nerve tracts two scientists at Johns Hopkins University, Baltimore Md., Drs Howard A Howe and David Bodian have been able to prove that it can enter the body by several doorways Through experiments with monkeys they have shown that the infection can reach the spinal cord by either the mouth or the nose

Insane Patients Helped by Electric Shock Treatment

FIGHTING insanity with electric shock is the most dramatic recent advance in the field of medicine At the New York State Psychiatric Institute in New York City, seemingly hopeless cases of the most common forms of insanity schizophrenia and dementia præcox, have been shocked back to apparent mental health by the new treatment. Electrodes at the ends of a caliperlike instrument, are placed just in front of the ears on the patient s head From seventy to 100 volts of current pass through his brain The result is a violent convulsion resembling an epileptic seizure

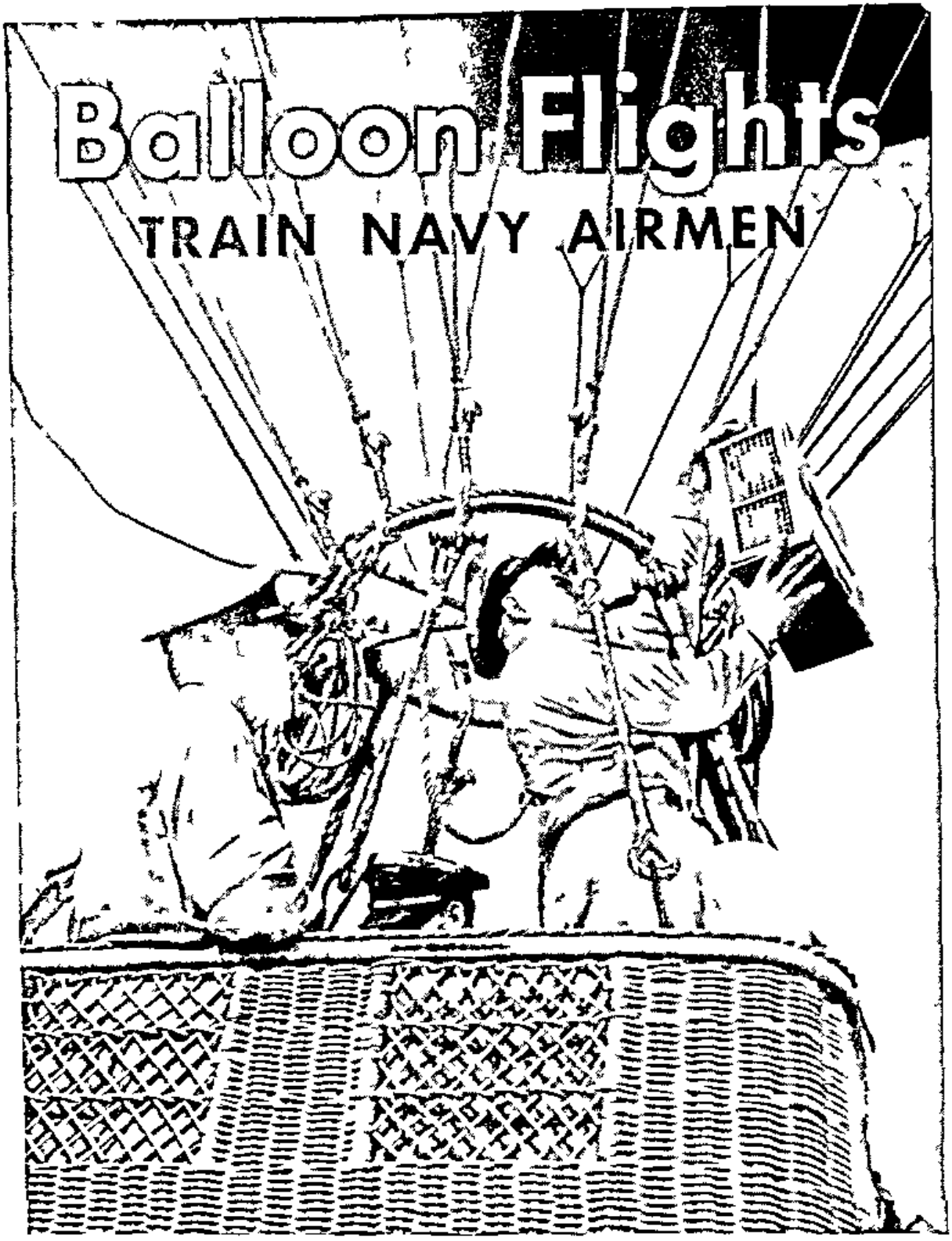
In some cases, a single electric shock achieves what seems to be a medical miracle, restoring the patient to sanity Previously, insulin, snake venom and metrazol, have been used to produce shock The electric treatment is painless leaves no after effects and costs less than shock producing drugs





Simple apparatus for treating insanity by electric shock At right electrodes are being adjusted to the head of a sufferer

Balloon Flights TRAIN NAVY AIRMEN



Ready for an ascent Navy ae onauts take aboard a cage of p geons to carry reports back to the r base

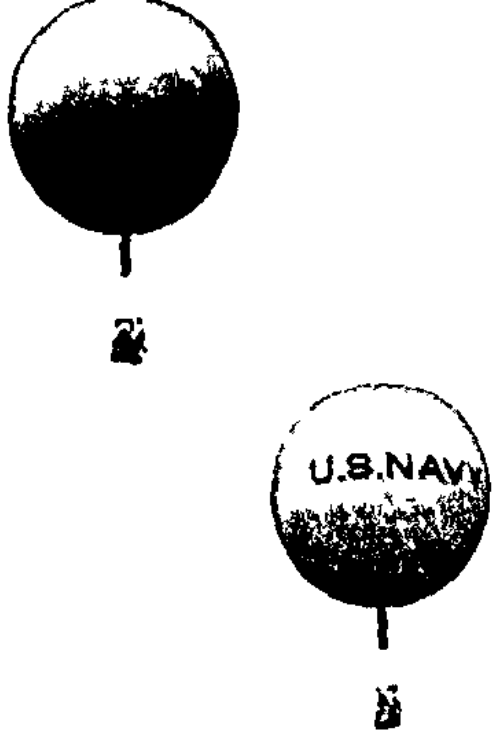
WITH dive bombers and 400 mile an hour fighting planes in the head lines few people know that the drifting free balloon the earliest of all aids to aerial warfare is still an essential link in America s defense program From the field at Lakehurst N J where the bal loon school of the U S Navy is entering its twentieth year silver hued gas bags have traveled a total of more than 25 000 miles in training flights Because a blimp with a disabled engine must be handled like

By ROBERT E. MARTIN

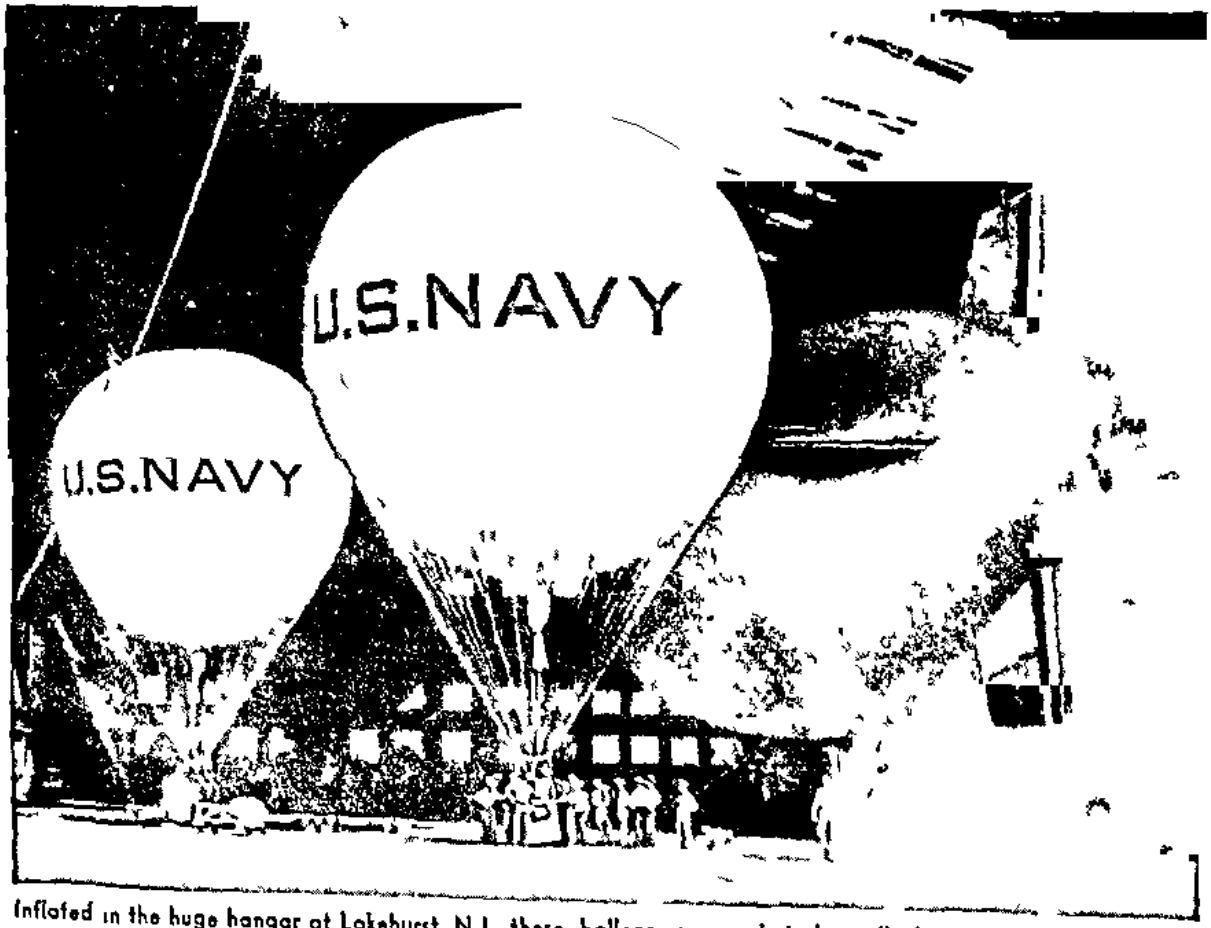
a free balloon, all men in the Navy's lighter-than-air service begin with a balloon course at the Lakehurst school

The six 35 000 cubic-foot balloons used in the work are inflated with helium As one of them is filled for a flight, the ground crew adjusts the netting carefully so the five-foot-square wicker basket is exactly centered With as many as four students and an instructor squeezed into the basket, the ground crew 'walks the balloon, towering seventy feet in the air, out onto the field from the hangar in which it was inflated Instruments road maps a woodsman s compass and carrier pigeons are loaded aboard Then comes the start A shower of sand ballast, a slight upward push by the ground crew and the great gas bubble soars away So silently does it drift through the sky that men calling upward from the ground can be heard distinctly at an altitude of 1 000 feet

During the first five flights the student watches and learns On each trip he performs some new task in connection with navigating the balloon To rise he throws overboard ballast to descend he lets out gas through a valve at the top of the bag Throughout a flight, there is a continual small seepage of gas so that ballast has to be discarded from time to time to keep afloat. To a balloon ballast is what fuel is to a plane,



The start Free balloons are directed by seeking levels where favoring winds blow

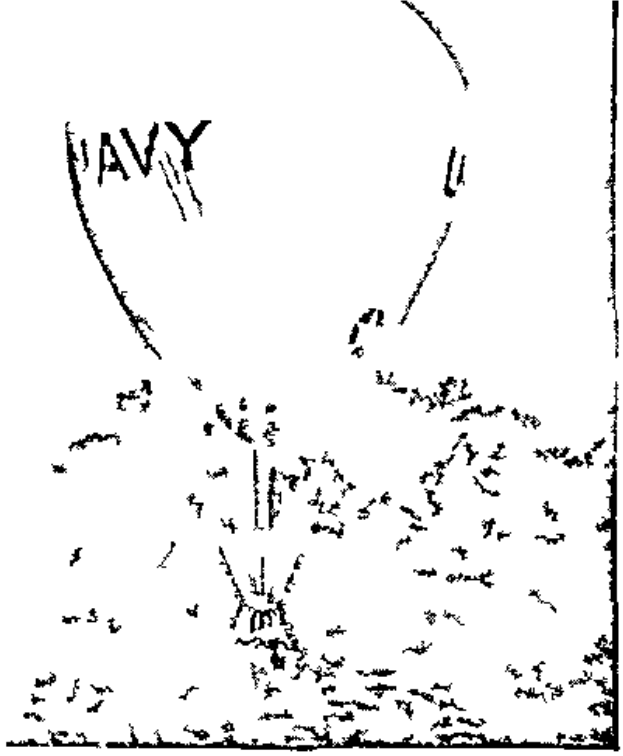


Inflated in the huge hangar at Lakehurst, N.J., these balloons are ready to be walked out by ground crews

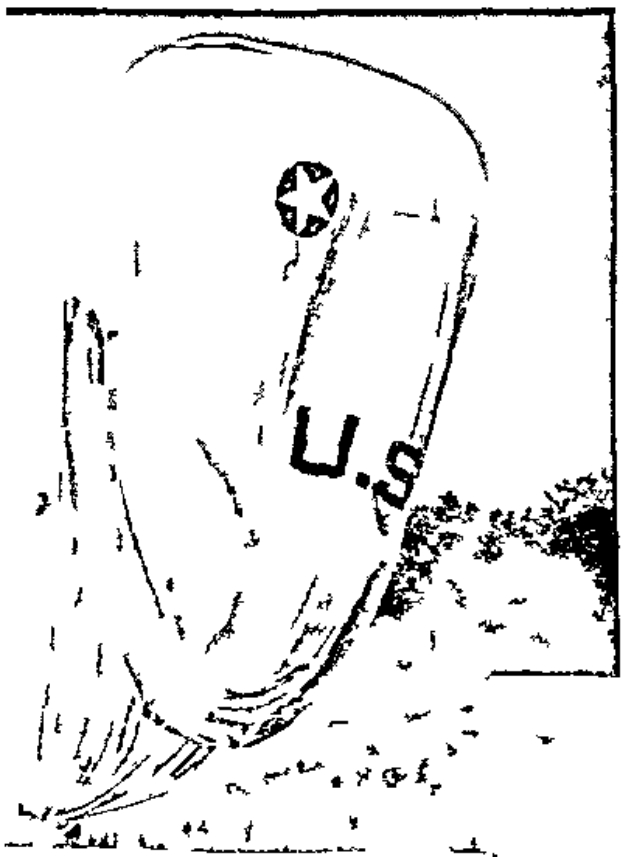
when it is exhausted, the flight must end.

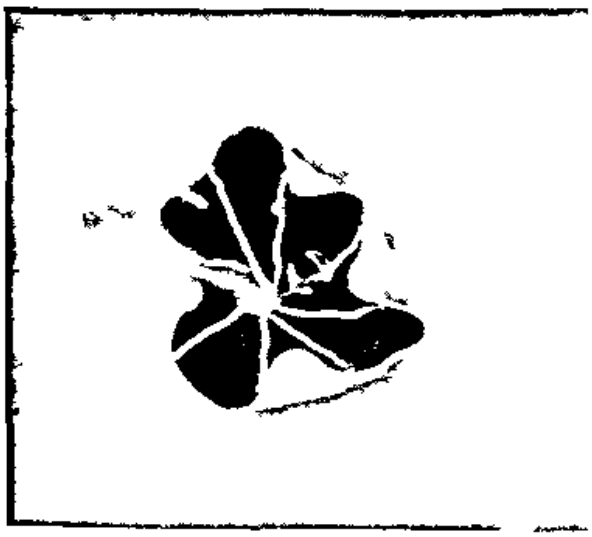
Some years ago before helium was used in Navy balloons Lieutenant Commander Samuel M. Bailey and two students from Lakehurst were riding under a hydrogen filled gas bag in pitch darkness over the Alleghenies For hours their balloon had been losing lift At one o clock in the morning Bailey decided to settle in for a landing The basket was four feet from the ground when high tension wires loomed directly ahead Bulging with thousands of cubic feet of explosive hydrogen the great bag struck the cables. At the same instant, both students leaped The balloon bounced back and then shot like a cannon ball toward the sky By hanging to the valve rope all the way up Bailey stopped the zoom at 8 000 feet and descended unharmed on a mountaintop farm

Overnight flights are next to the last ones made by students at the Lakehurst school. As a special precaution the Navy sends a warning to all airline pilots to watch out for the balloons Two lights a steady white one and a flashing red one are suspended under the baskets Both are battery run Because of the more even temperature at night, two bags of ballast will often carry a balloon through the hours of

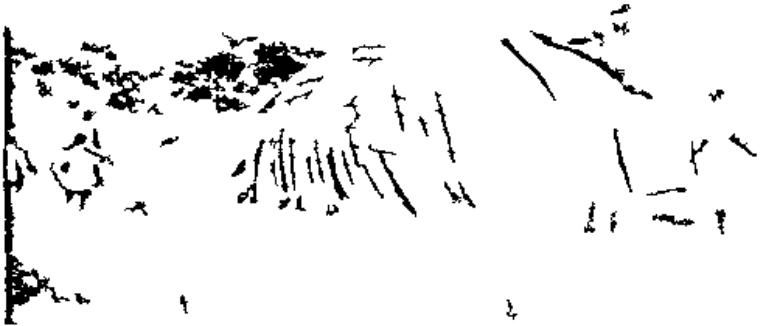


Ea ng down fo a a d ng the ba ket sk p th ough a f nge of e befo e com ng to e t n a f eld





F ye s leap to he g ound a the bag set e w th p pane open At uppe ght a ew th ough the append x show g open a e R gh the en e ope nea y flat



darkness On the other hand during one day trip Lieutenant Commander R F Tyler had to throw out five bags—150 pounds—of ballast from an altitude of 500 feet to keep from being carried to earth by a strong downdraft over a cool swamp a few miles from Lakehurst

Solo flights which end the training are never started if the breeze is blowing faster than fifteen miles an hour and all trips begin only when the winds blow from an easterly direction carrying the balloons inland away from the near by Atlantic With the wind as navigator carrying the gas bag in whichever direction it blows the Navy balloon riders are never sure where they will land One crew last year descended in the middle of a cemetery another in brambles six feet high

Whenever possible the landing is made just beyond woods so the trees form a windbreak Valving out gas the pilot brings the basket to within fifteen feet of the ground Then he jerks the ripcord tearing out a long panel in the side of the bag The gas rushes out the bag collapses and the flight is over

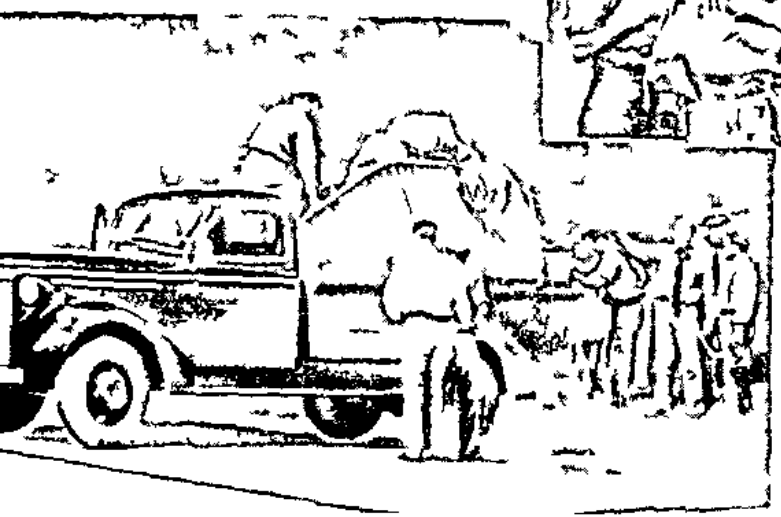
At the end of every overnight journey pigeons are released to carry back word of the landing location and the bag and basket are shipped home by freight. During shorter daytime trips a truck follows the drifting balloon to pick up the equipment and crew

The simplest job these Navy truckmen ever had came at the end of one training flight last fall The balloon took off in the morning and drifting west on a sea breeze disappeared Late in the afternoon it reappeared over the field riding a wind that blew in the opposite direction at a higher level and descended for a landing only a few hundred yards from its starting point



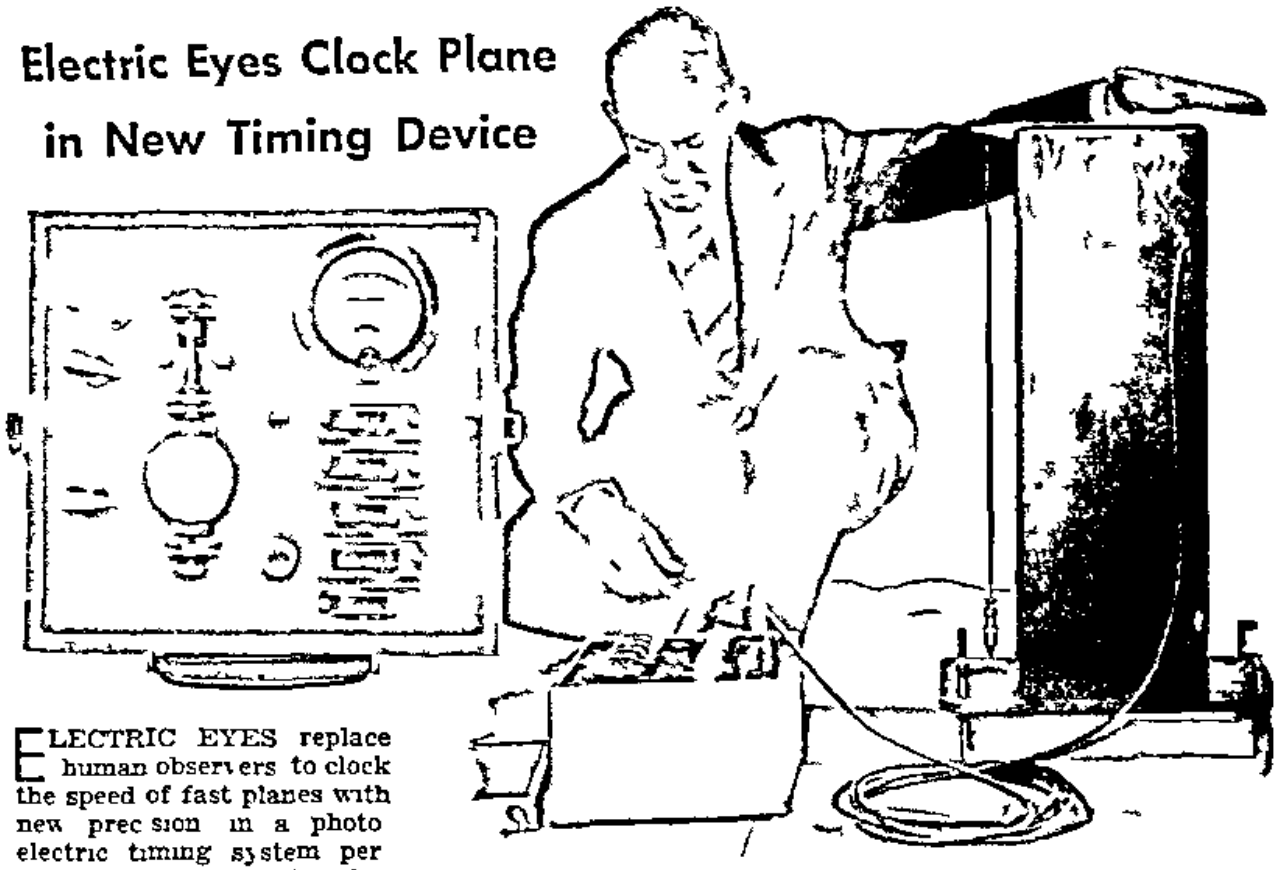
In flight altitude is gained by dumping sand ballast in bags or from pockets on the side of the basket as above





After the landing pigeons are released with reports to headquarters Then the bag is carefully rolled up and placed in the basket At the left the balloon is loaded on the truck which has followed its flight

Electric Eyes Clock Plane in New Timing Device

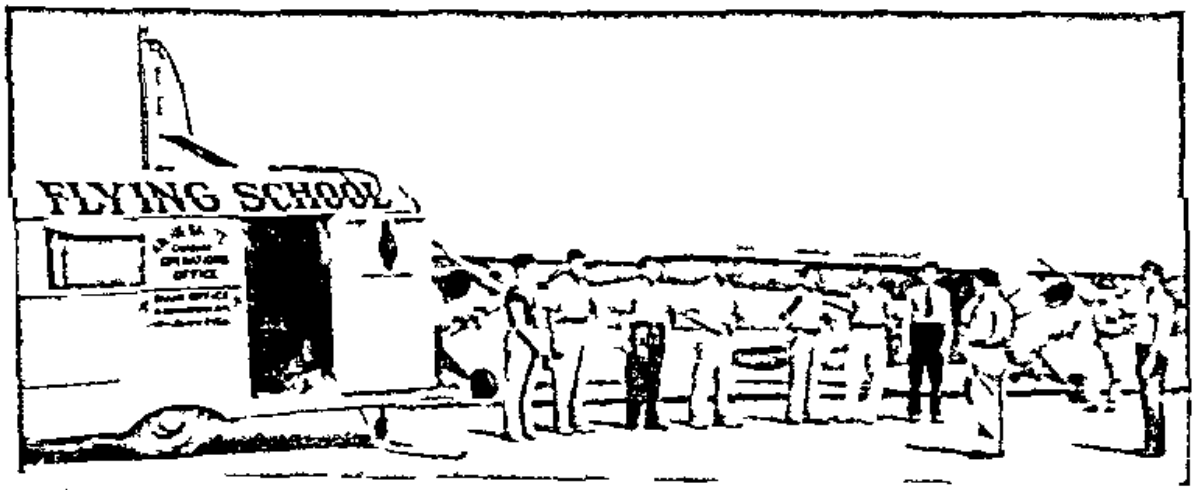


Planes fly ng over vert cal boxes l ke the one above actuate photo-elect c ce s to start and stop the watch on the panel at the left

ELECTRIC EYES replace human observers to clock the speed of fast planes with new prec sion in a photo electric timing system per fected by a Los Angeles Calif test pilot. Inclosed in vertical boxes open to the sky the l ght sens tive cells are placed at the start and finish of a carefully measured course As the speeding plane passes over the first box, it d ms the light reaching the cell, which responds by starting a stop watch The second cell similarly actuated, stops the watch. By comparing the elapsed time with the length of the course the plane s speed is readily computed. A half mile suffices for the course and approach.

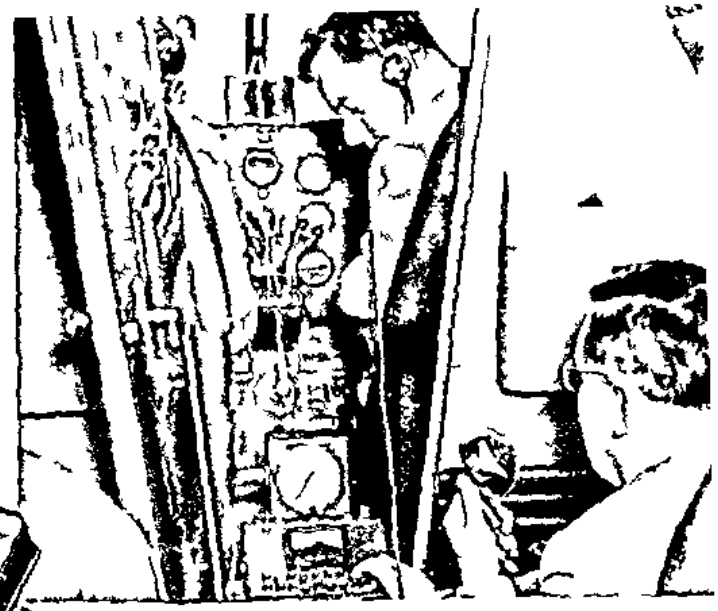
Trailer Serves as Office for Airport Flying School

TRUNDLED out on Floyd Bennett Field New York a rolling airport office makes a convenient headquarters for Archie Baxter while he teaches a group of fl ght students what to do with a plane Posted ins de the walls of the trailer his orders of the day inform his three assistants of the work cut out for them



Fly ng students l ned up n f ont of Arch e Baxter s roll ng off ce at Floyd Bennett F eld New York

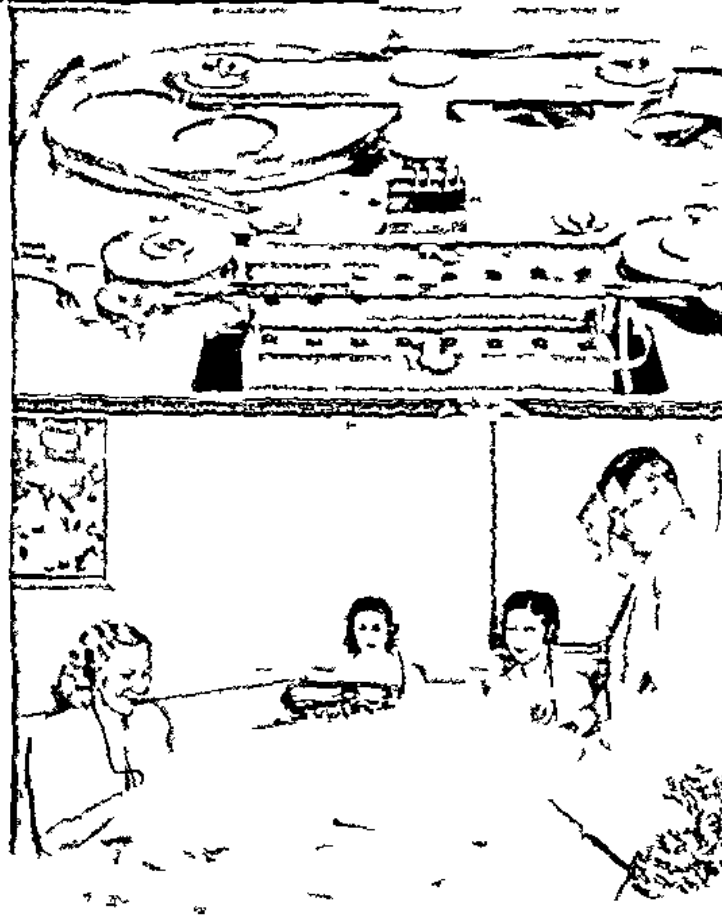
Test-Flight Recorder Puts Sixteen Voices on a Single Tape



Words spoken into microphones anywhere in the plane by p lots and eng neers are duly recorded

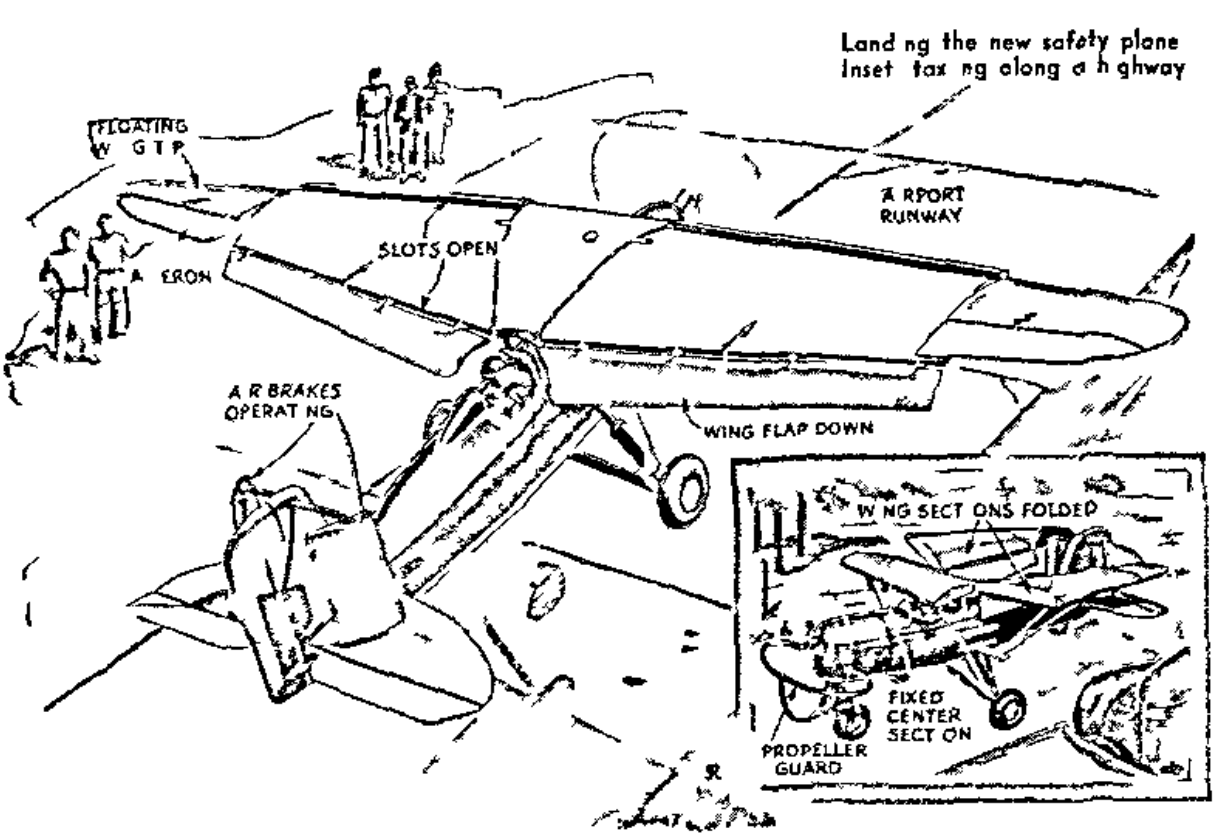


Left and below de ta ls of recorder Two metal tapes pass by rows of e ght stepped magnets wh ch record up to s xteen messages in magnet zed l nes on the two tapes Typ sts w th earphones transcr be messages



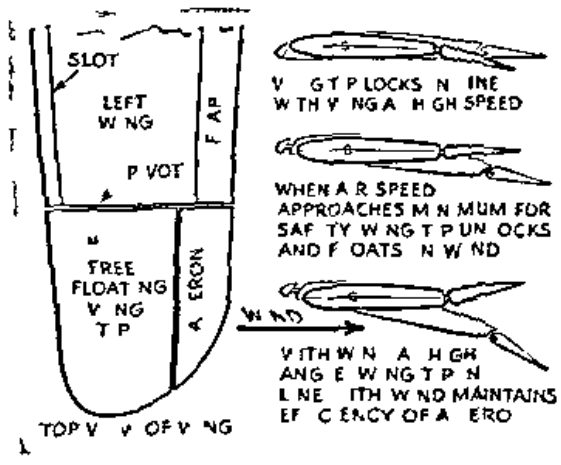
SIXTEEN men may talk at once through mouth or throat micro phones into a remarkable dictating machine for use during air plane test flights Pilots and en gineers at various stations in a plane may thus record their observations simultaneously Any one of the voice channels will also reg ister mechanical vibrations occur ring at the individual pick up stations When the plane lands the apparatus plays back the recorded voices which are transcribed by of fice secretaries wearing earphones and sitting at typewriters

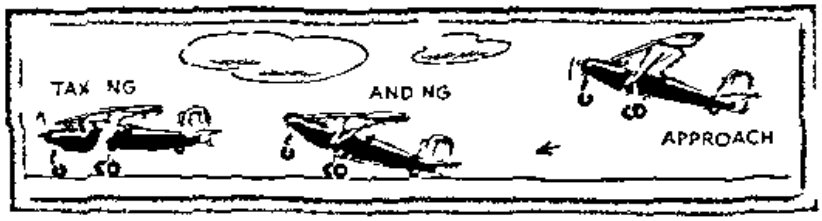
Through a standard sound record ing process voices and noises are imprinted magnetically upon a pair of moving steel ribbons each half a mile long and a quarter inch wide The novelty of the new multiple re corder, devised by Herman S Heller of Los Angeles Calif lies particularly in its ability to make a sin gle tape carry as many as eight unscrambled recordings



Floating Wing Tips Give Added Safety to Light Plane

FOP comb ning safety features of unusual variety in des gning a l ght monoplane for private flyers Emil Doehler of Buffalo N Y has won expert commendation Vert cal flaps of his own invent on flanking the rudder supplement standard wing flaps as air brakes Turned inward they help to reduce landing speed—elimmating side slipping or fishtailing into a small field—and also concentrate air flow upon the rudder so as to retain effective control Wing slots at leading and trailing edges assure needed lift by providing an even stream of air over the surface Allerons mounted on floating wing t ps which line up with the wind like weathervanes give full response at angles of attack large enough to make ordinary ailerons in effect ve After a three point landing us ng a tail wheel the craft settles forward upon a tricycle landing gear and wheel brakes bring it to a quick stop Hinged wings will swing back aga nst the fuselage to reduce the cost of rented hangar space In bad weather a pilot could make an emergency landing on a h ghway fold the wings and drive away Because of the roadability of the machine the designer has added a propeller guard

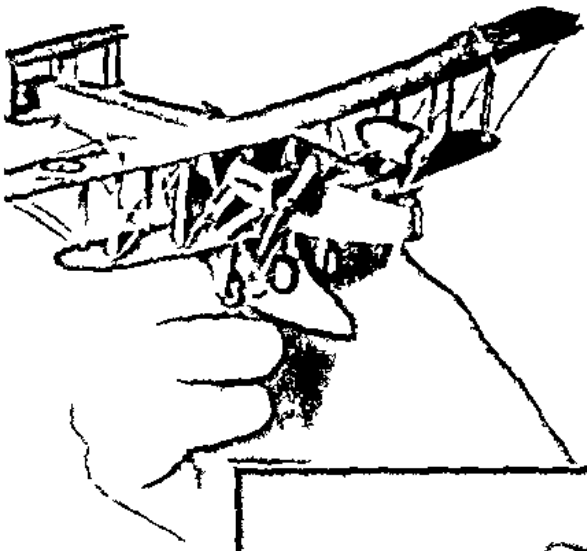




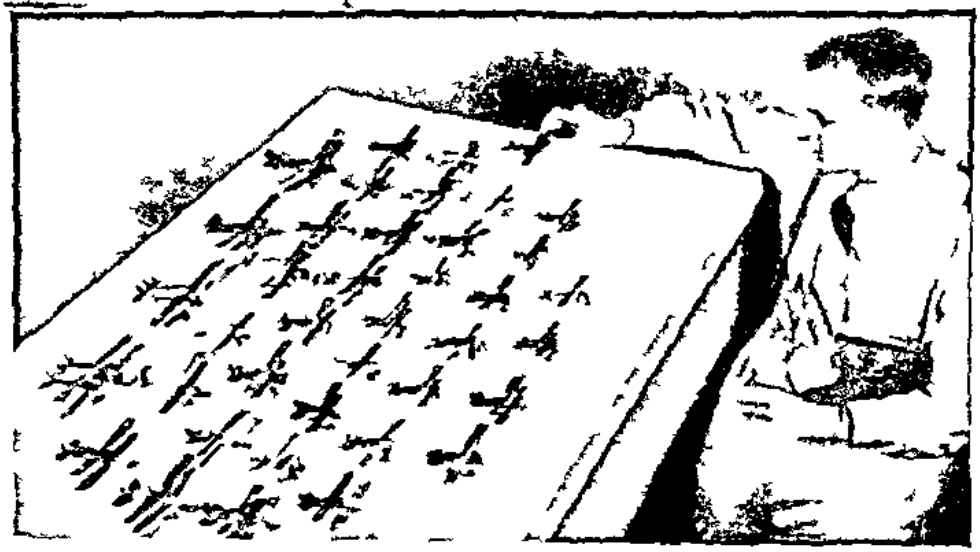
How a le ons on float ng w ng t ps g ve full effect w th the w ngs at any angle

D aw ng at left shows how plane lands on ta l wheel tax s on ts t cycle gea

Table-Top Armada Shows Famous World-War Planes



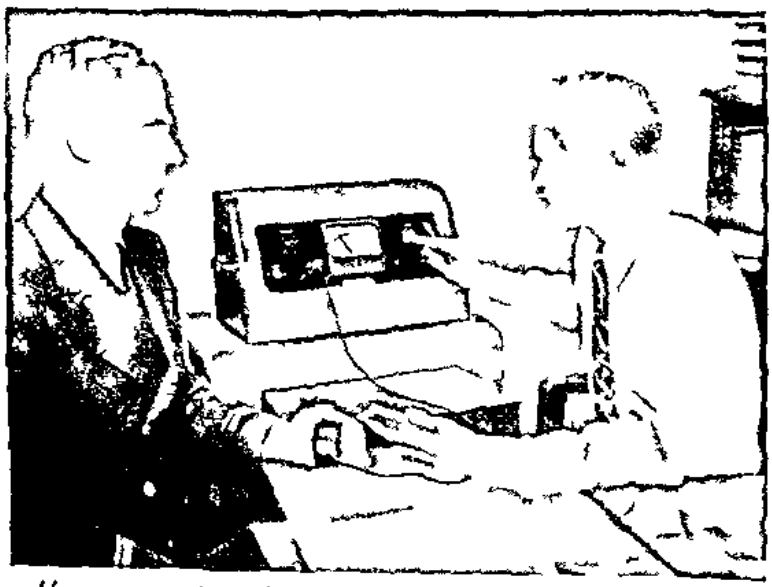
A TABLE TOP air fleet of midget fighting planes representing most of the aircraft used in the first World War has been assembled by Allan F Kitchel Jr of New York City All of the models have been constructed to the same scale one eighth of an inch to a foot The first plane Kitchel built was a miniature reproduction of Von Richthofen s famous Fokker triplane This and later models were all created with wooden bodies and wings carved with a jackknife and razor blades while the flying wires were added with a needle and thread To hollow out the cockpits of the midget planes Kitchel used a heated nail



A Handley-Page bomber dating from World War No 1 Landing gear did not retract

Allan Kitchel poses beside his carefully modeled collection of historic planes

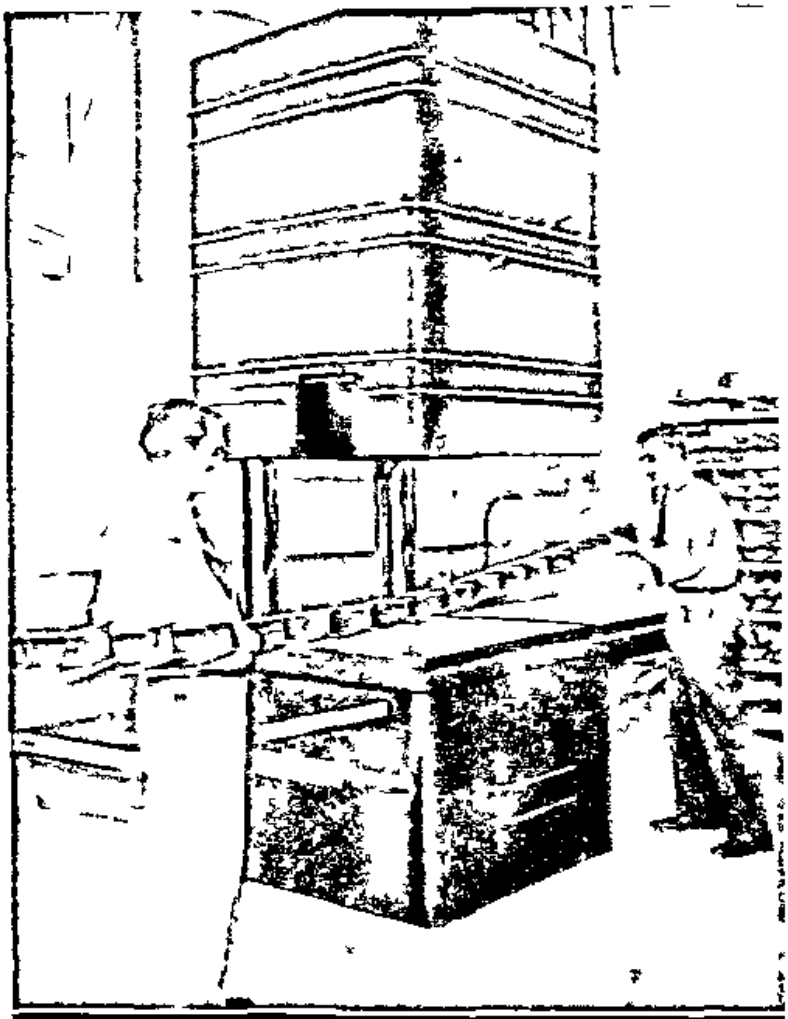
Lie Detector Tests Emotional Make-Up of Air-Line Pilots

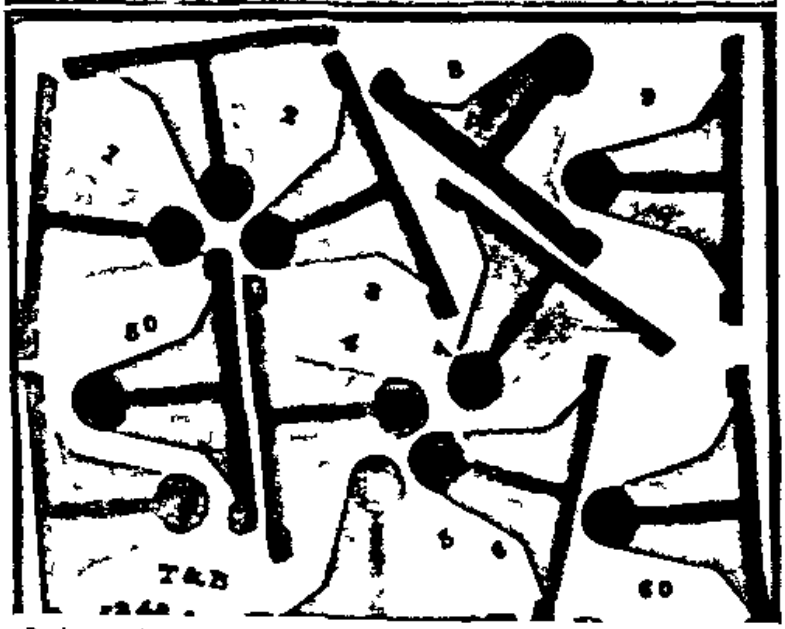


How a prospective pilot is tested for various emotional reactions

TO DETERMINE the emotional stability of prospective pilots American Airlines has begun making tests with the lie detector a delicate electrical apparatus developed for use in criminology After electrodes are strapped to the hand of the subject minute variations in body current are noted as the test placing the prospective pilot in various emotion producing situations progresses A record of these variations in body current enables the operator to obtain a picture of the emotional make up of those applying for positions as pilots

X-RAY MACHINE SPEEDS





Radiograph of small airplane parts each numbered for the record Above feed ng a long structural member through the X-ray mach ne

TO DETECT invisible flaws in airplane fittings, Tom Triplett and Victor Barton have X-rayed 1 000 000 parts during the last five years, in the Lockheed plant at Burbank, Calif. This year, alone, they expect to equal or exceed that figure. What makes the speed up possible is an automatic X ray machine they have developed, capable of exposing 114 sheets of fourteen-by seventeen-inch negative every minute. A marvel of mechanical precision, it adapts assembly line technique to what has hitherto been a time-consuming bottleneck in production. Ten of the devices, it is estimated, would make all necessary radiographs for America s goal of 50 000 planes a year!

Standing ten feet high and four feet square, the big X-ray machine handles the largest airplane castings made. Open gates, on each side of its cabinet, permit making section-by-section "panoramas" of fabricated pieces up to two feet wide and thirty feet long Dozens of smaller parts may be X rayed at once. If stepped-up production of transports and bombers demands a higher tempo than is possible by hand feeding, a continuous conveyor belt will carry the parts to the apparatus.

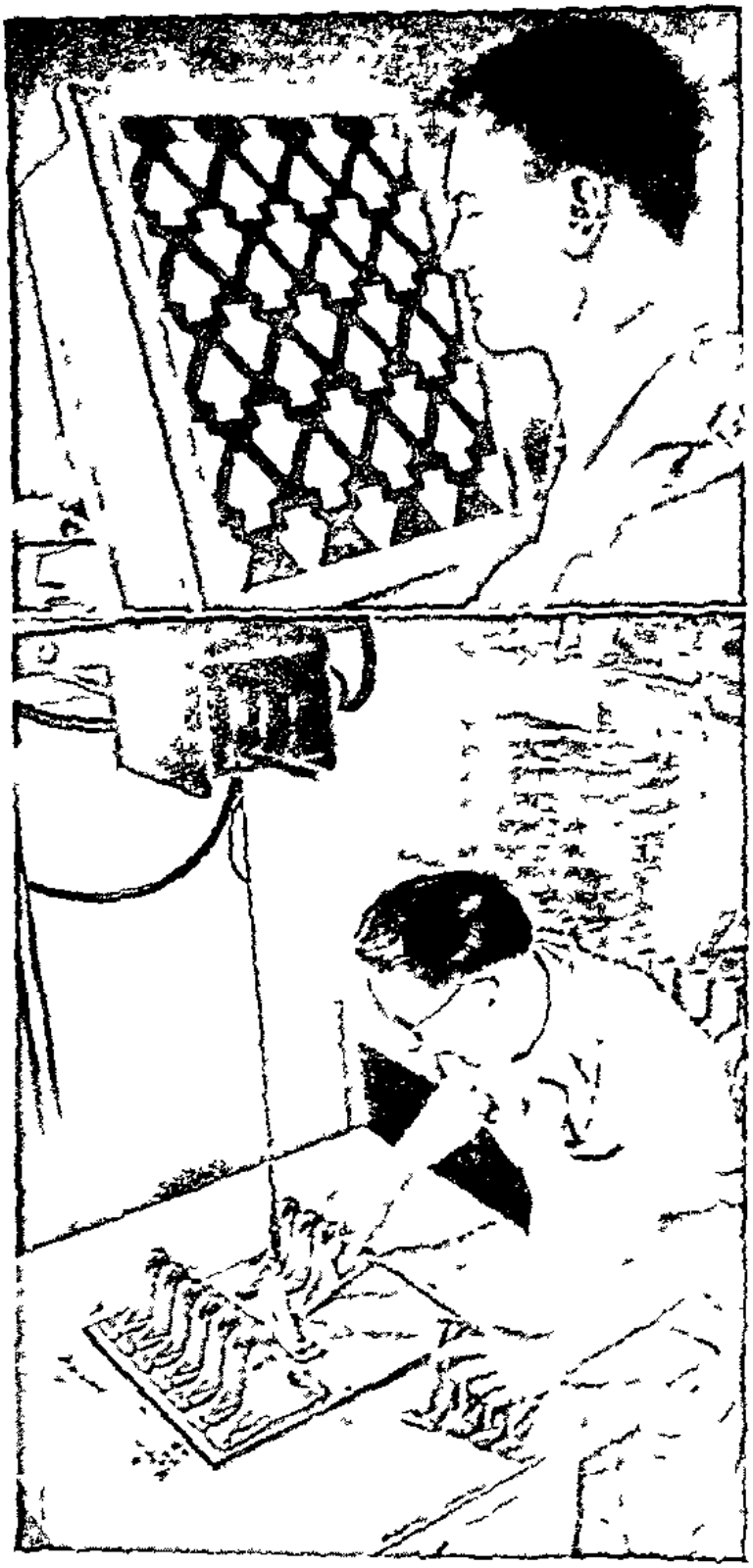
Shielded from the dangerous rays by 1 500 pounds of lead that sheathes the cabinet, the operator stands alongside the machine Once he has preset its controls, for the desired exposure and rate of feeding, he can devote all his attention to getting parts on and off the conveyor If the powerful X ray tube within the cabinet burns out, it can be replaced in sixty

UP PLANE PRODUCTION

seconds An electric lift raises and lowers the housing, and the tube plugs directly into its transformer, eliminating high voltage cables

As intently as a surgeon would study an X ray of his patient, experts examine the developed pictures of the castings in illuminated viewers designed especially for the purpose If a part is of uniform thickness, and contains no defect, it will give a shadowgraph of perfectly even grayish tint. Let there be such a flaw as an air pocket or a cavity caused by internal strains however and the X ray "fingerprint promptly reveals it Since the rays pass through less thickness of metal at this point they give a stronger impression leaving a spot of different tint on the picture Even in views of castings of irregular thickness, where some parts naturally appear blacker than others, the engineer's trained eye instantly spots any telltale blemish in the X ray impression. Since every part is numbered for identification, any offending one may speedily be traced and discarded, saving lives that might be risked by its failure in flight.

For fittings that pass the test, the identification numbers enable a record to be made of the plane into which each one goes Thus a continuous history may be kept of the performance of all "stress parts,' the hidden but vital elements that bear the strain of banking, diving, and twisting in modern aerial combat. If one of them fails in action, its X ray record can be checked and the spot where failure occurred can be studied for redesigning



Centering castings to be photographed In the upper picture an X-ray technician is hunting flaws in a negative showing forty-one parts

Life-Preserver Coat Keeps Man Afloat

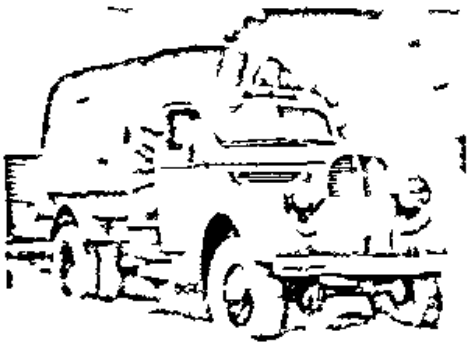




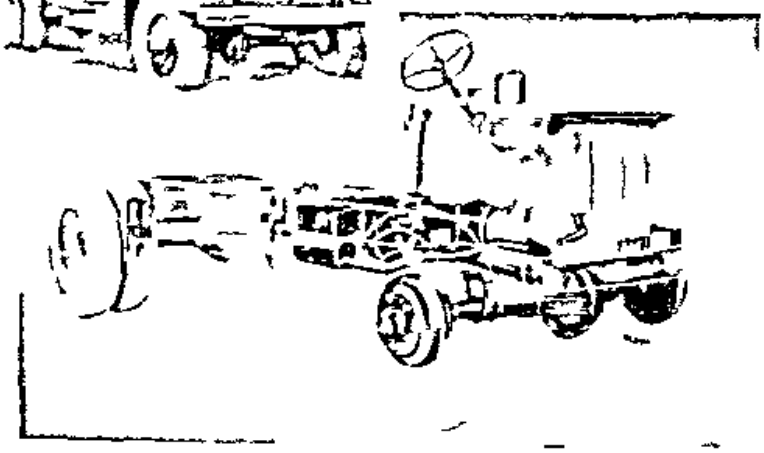
Test ng the l fe p eserve ove coat p oposed for B t sh fors Left coat n regula use

A LIFE SAVING overcoat, declared capable of keeping four men afloat, has been submitted to the British Admiralty by an Engl sh inventor Beneath its gabardine exterior the garment is lined with a ma terial six times as buoyant as cork In con sequence it is reported to weigh less than half as much as the present service great coat, while it is also many times warmer owing to its heat insulating qual ties Thus the life saving device not only conforms to government specifications for wearing apparel but also offers increased comfort, together with its service in a sea disaster

Conversion Unit Gives Motor Trucks Four-Wheel Drive



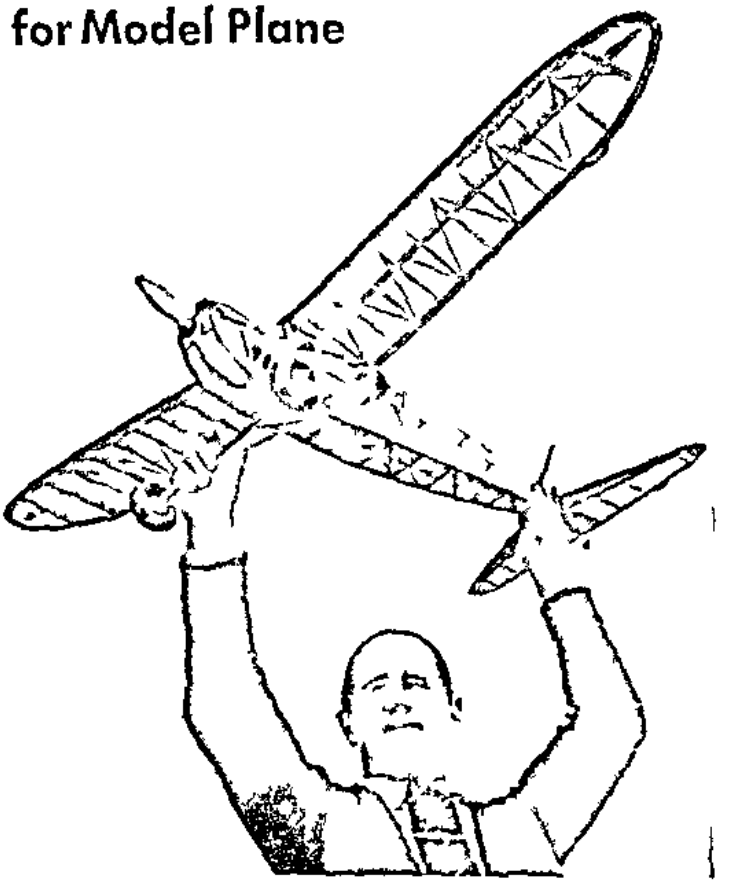
A truck converted for fou wheel d ve The v ew below shows nsta lat on of un t



HEAVY GOING becomes easy for motor trucks when a new conversion unit transforms them from t vo wheel to four wheel drive To make the change an aux l ary transmission is installed, and a new front axle with a uni versal joint and spe cial steering ends is substituted for the old one. The result ing four wheel trac tion enables trucks to wallow through mud sand brush or swamps negotiate soft cuts and fills in road construction work and enter and climb out of excava tions On paved high ways covered with snow or ice it gives more even traction and greater security at curves or hills.

Cellophane Covering for Model Plane

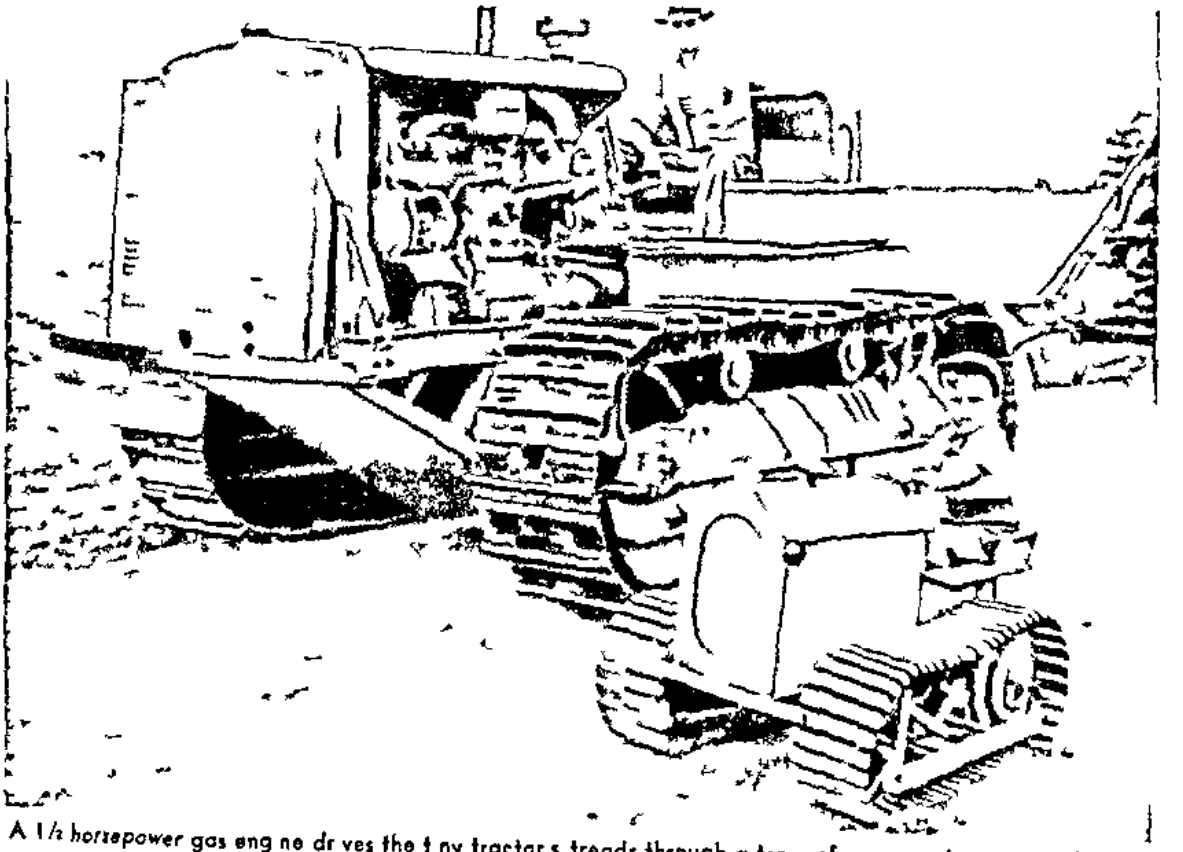
THIN sheets of cellophane held on with model airplane cement form the covering for a model plane built by Jack Schieder of Trenton N J Pe vealing the workmanship within the wings and fuselage the covering shrunk tight by a steam bath also provides an ideally smooth surface for the gas powered model Neat re pairs are quickly made on the covering by patching on strips of transparent Scotch tape



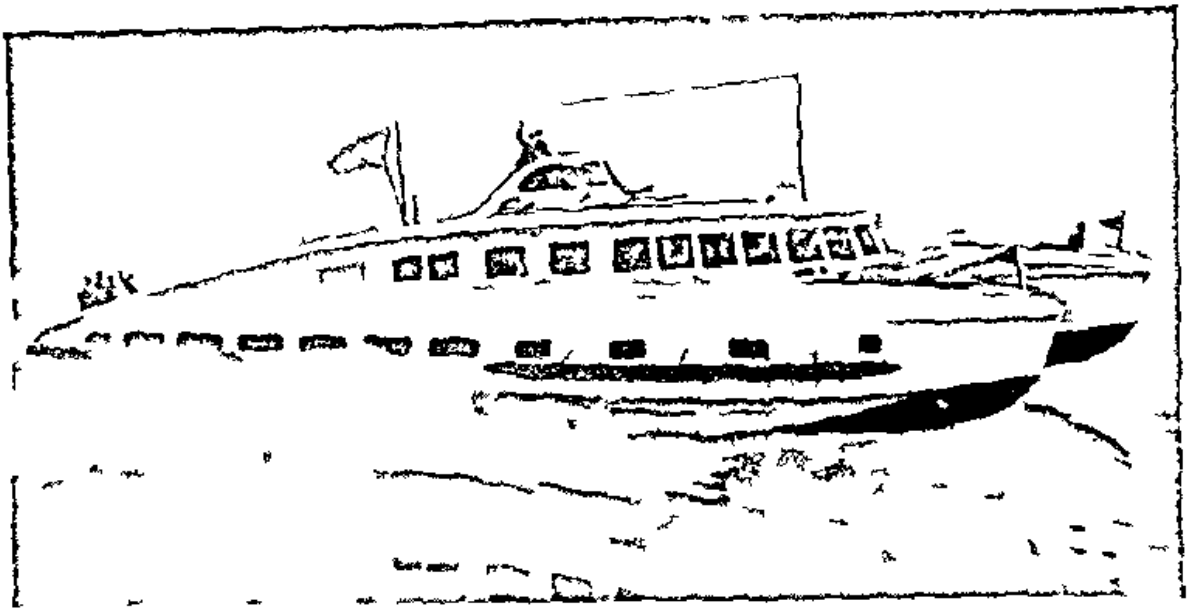
The transparent cover ng shows up the plane s construct on

Boy's Midget Tractor Is Just Like His Dad's

WHILE Marcus Ming Sr a Mississippi county road super intendent is towing heavy ma chinery with his huge track type tractor Marcus Jr is usually at home towing his playmates wagons here and there with his own 1½ horse power working model of his dad s juggernaut Father son and machines are below

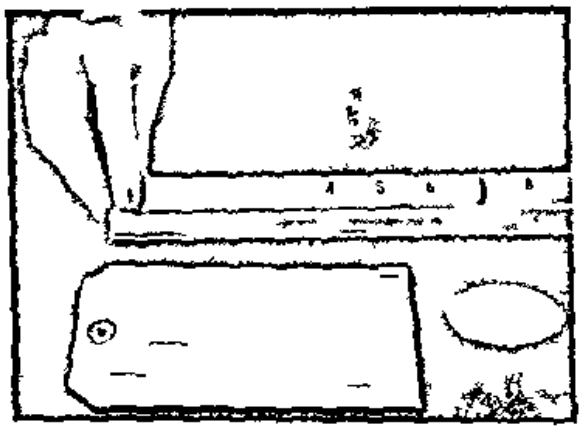


A 1/2 horsepower gas eng ne dr ves the t ny tractor s treads through a tra n of gears and separate clutches



Twin-Hulled Passenger Cruiser Hits 50 Miles an Hour

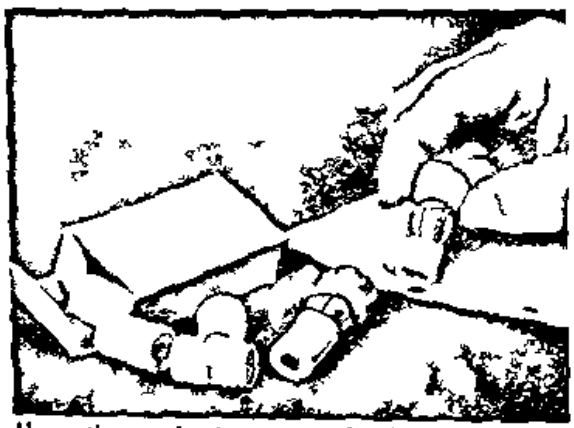
HURTLING across the waters of the western shore of the Black Sea at fifty *miles* an hour the twin hulled streamline craft p ctured above carries passengers *mail* and express in a recently inaugurated service between Sochi and Sukhum in Soviet *Russ a* Planing the entire distance on its novel W shape bottom the express cruiser boasts a commod ous cabin straddling the two hulls and open cockpits fore and aft



The tag has nst uct ons fo bend ng the new p pe

Division Marks on Steel Pipe Make It Easy To Measure

STEEL TUBING of the rigid conduit type used to carry wires close to machinery and fuse boxes or down the sides of houses from overhead l nes is now available in ten foot lengths marked in inches and feet to facilitate cutting it into desired sections Special d rections for bending the *pipe* are furnished on a tag which also *carries a* chart to show instantly the length of p pe taken up by each bend The interior of the pipe has novel raised and rounded knobs that make it easier to slide wires through



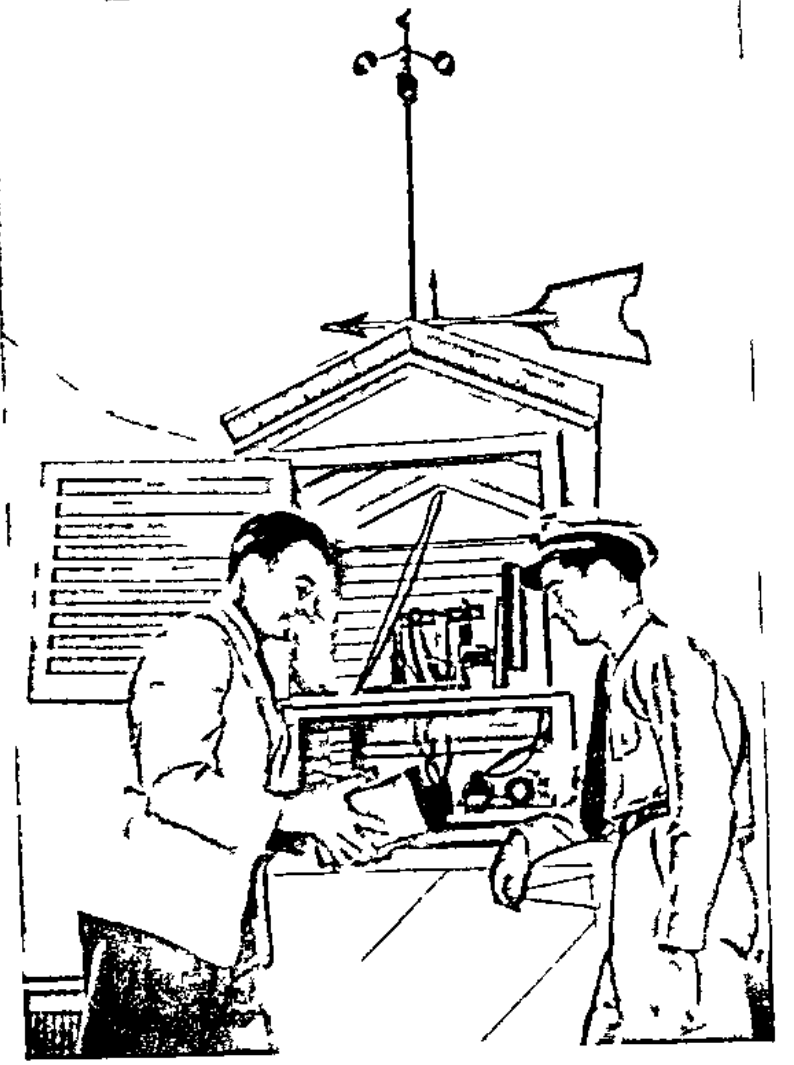
Using th s appl cator gummed tabs can be stuck to notebook pages f ve t mes as fast as w thout t

Gummed Rings for Notebooks Come in Handy New Form

GUMMED reenforcements or tabs for the holes in the pages of loose leaf notebooks are now being furnished in stacks like doughnuts on a st ck to facilitate attaching them As shown in the illustration at the left renewal packages of the tabs *come* ready stacked for placing on the applica tor In use the bottom tab is dampened and the applicator pressed against the *page* The gummed tab is left sticking to the page when the appl cator is l fted and the next sticker is immed ately ready for attaching Much time may be saved with the *device*

Robot Observer Radios Report on the Weather

NO WEATHER MAN need tend the compact observatory pictured at the right for electric attachments interpret the readings of its numerous instruments and an automatic radio transmitter puts them on the air Receiving stations thus obtain complete information on the air temperature barometric pressure relative humidity speed and direction of wind and rainfall at the observation post Developed by Wilbur S Hinman Jr of the National Bureau of Standards the robot stations are especially suited for remote or hard to reach locations where the maintenance of meteorological observers would entail physical hardships or undue cost. A trial installation at Washington D C pictured at right, is reported to have given thoroughly satisfactory service in exacting tests Because of the simplicity of the mechanism there is little about it that can get out of order



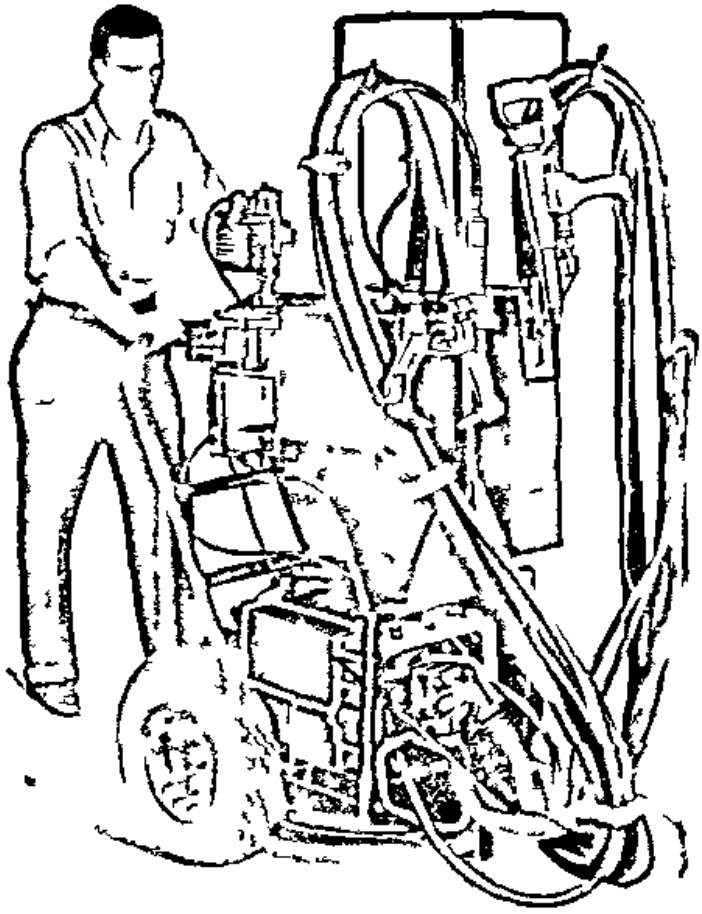
Automat c stat ons l ke th s report weather cond t ons by rad o

Ear Pads Protect Baseball Batters from Wild Pitches



Sl pped on l ke a pa r of rad o earphones the new baseball safety pads protect the s des of the head when the player goes up to bat

EAR MUFFS for baseball players are urged by Ford Frick president of the National League to guard batters against injury from pitched balls Made of rubber and leather the twin pads are joined like the ear pieces of a telephone headset and as easily slipped in place as shown in the illustrations at the left. Their generous proportions afford nearly complete protection for the head as the batter faces the plate while apertures permit perfect hearing Despite their effectiveness the lightweight guards are said to be no hindrance to the players



One man can wheel the weld ng mach ne wherever it is needed

Two-in-One Welder Rolls Up to Its Job on Pneumatic-Tire Wheels

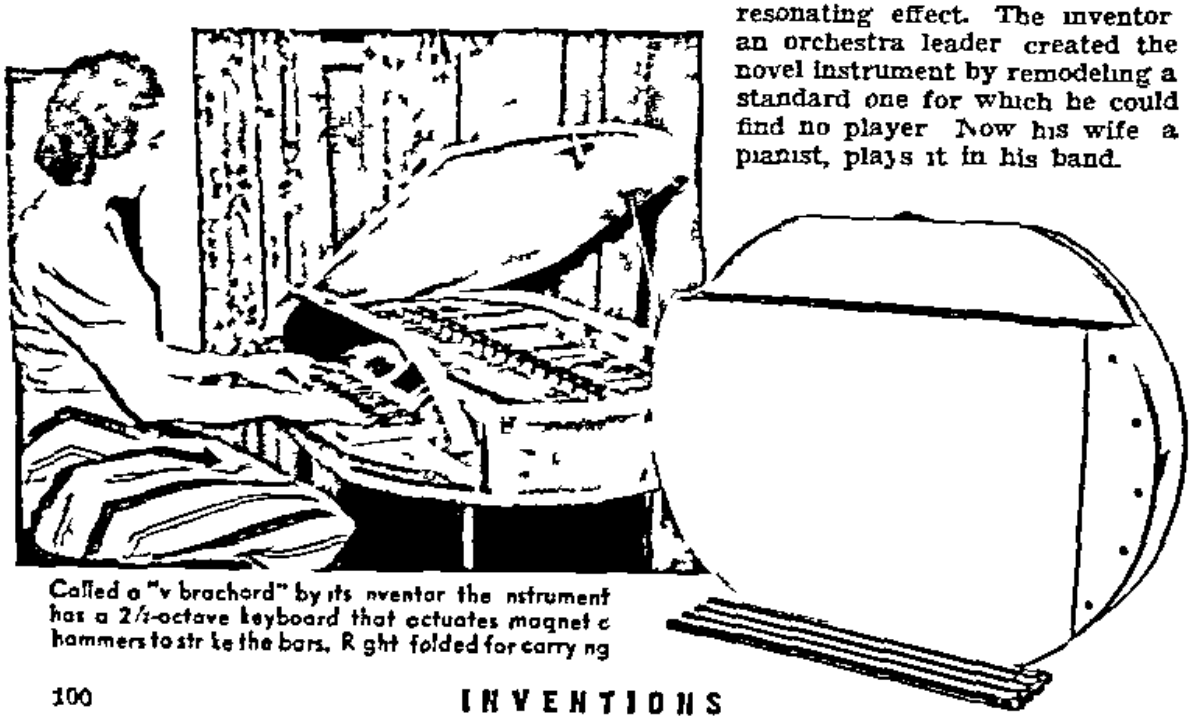
EQUIPPED with two welding guns a new shop outfit eliminates the need for duplicate equipment. Instead of requiring work to be brought to it, the unit rolls on pneumatic tire wheels to the lo cation of the job Necessary con nections for air water and power can instantly be made A single transformer operates both weld ing guns and the transformer and gun jaws are water cooled.

New Enamel Gauge

RECENTLY developed by en gineers of the General Electric Company at Schenectady N Y a new electric gauge indicates differences as small as a ten thou sandth of an inch in the thickness of porcelain enamel applications The gauges have proved particu larly useful in the manufacture of refrigerators stoves and other enamel w are

Piano Keyboard Replaces Mallets for Playing Vibraharp

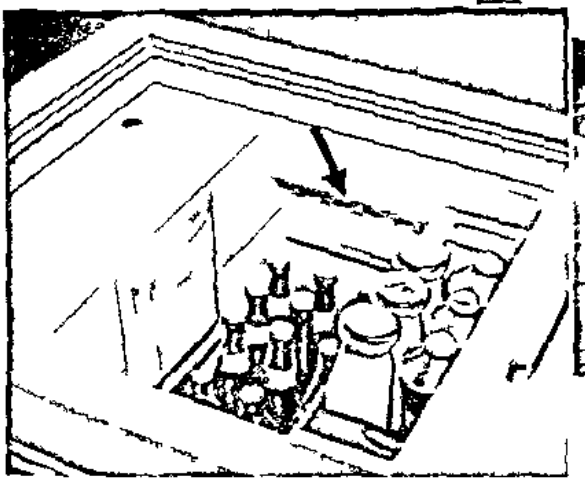
A PIANO keyboard takes the place of hand held mallets to play the vibrachord, latest addition to the xylophone family of musical instruments Depressing each key closes an electric switch and actuates an electromagnetic hammer that strikes a blow against the corresponding metal tone bar Separate switches control a vibrato-resonating effect. The inventor an orchestra leader created the novel instrument by remodeling a standard one for which he could find no player Now his wife a pianist, plays it in his band.

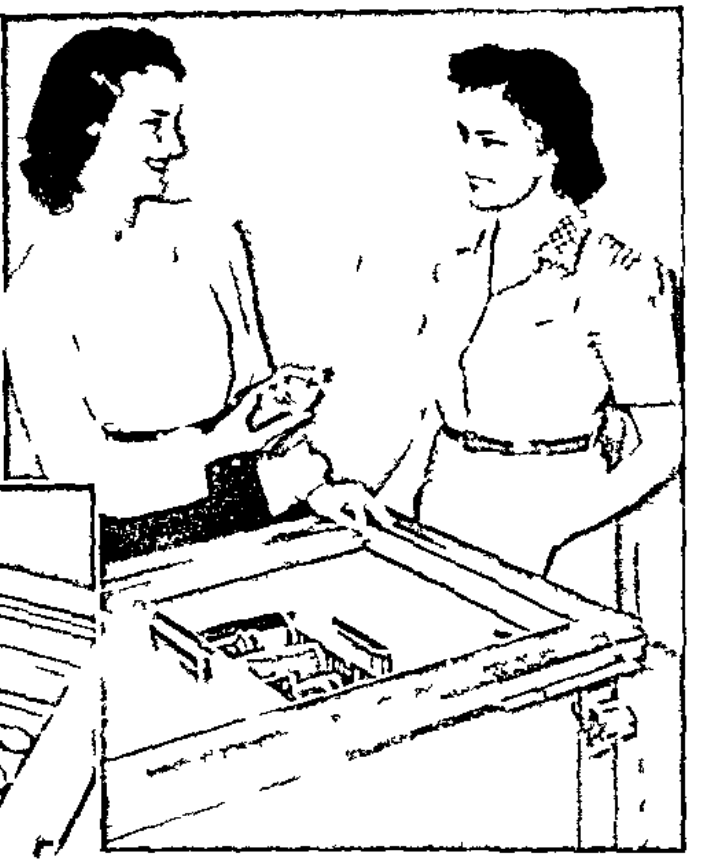


Called a "v brachord" by its nventor the nstrument has a 2½-octave keyboard that actuates magnet c hammers to str ke the bars. R ght folded for carry ng

New Bottle Cooler Substitutes Cold Air for Ice Water

TO DISPENSE bottles free from dripping moisture a new electric powered beverage cooler substitutes a blast of cold dry air for a tank of ice water Wire dividing racks within the refrigerated cabinet serve to segregate various brands of drinkables or to designate the warm bottles last added to the box Opening the top automatically turns on a light that illuminates the entire compartment When in place the stainless steel sliding top may be used as a counter or serving stand

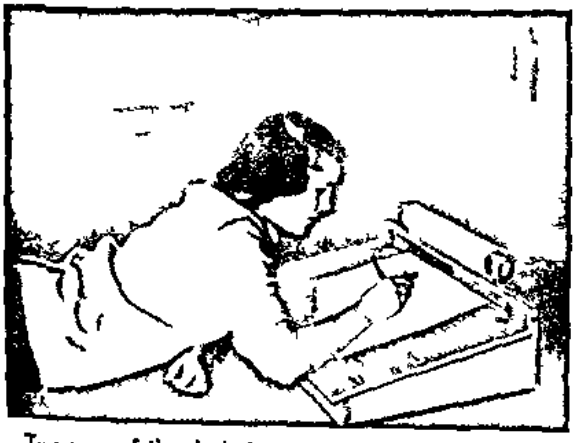


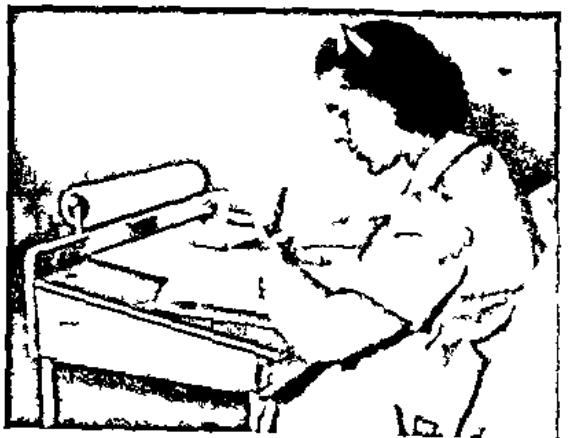


The arrow points to a row of air ducts from which cold air flows from the cooling unit A sliding top gives access to the bottles

Children's "Tummy Desk" Satisfies Their Yen To Sprawl

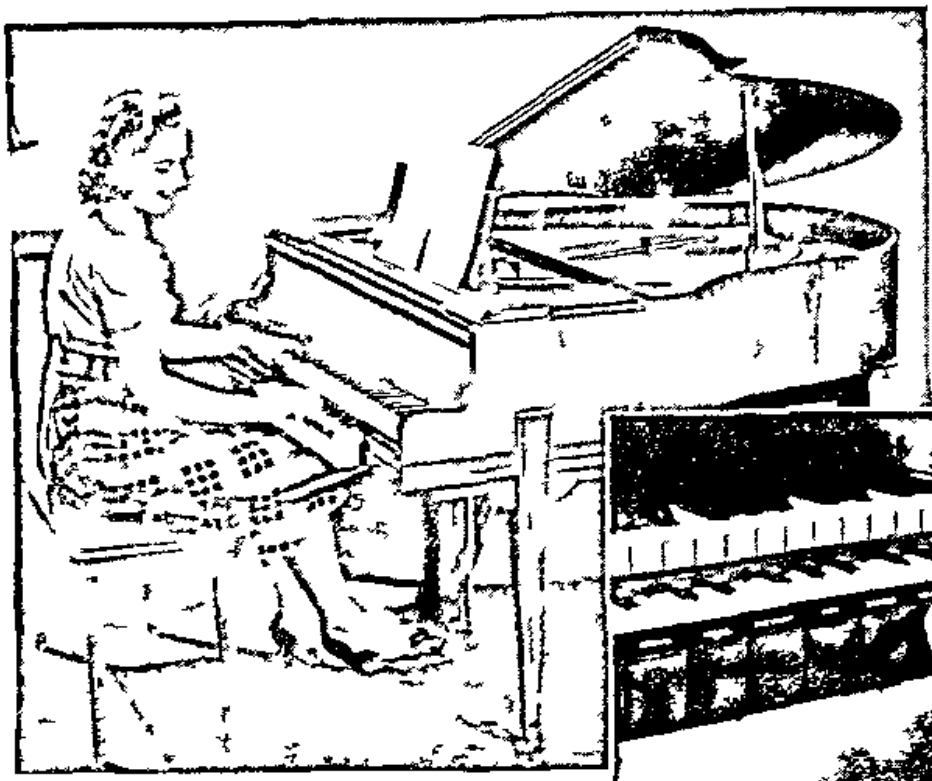
CATERING to children's quaint ideas of comfort a manufacturer has introduced a tummy desk for those who like to do their lessons on the floor It may also be used on a table top where its rubber feet prevent it from marring the finish When short, detachable legs are made fast it becomes a useful bed desk for children or adults Beneath the hinged top is ample storage space for books pads and pencils while a removable bracket at the back holds a large roll of scrap paper for scribbling





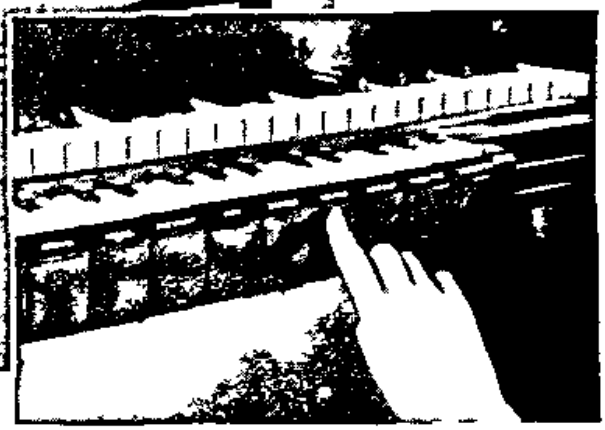
Two uses of the desk designed specially for children With legs removed it may be placed on the floor as at the left At the right the short legs are attached and it becomes a desk for working in bed

Electrical Attachment for Piano Plays Instrumental Solo

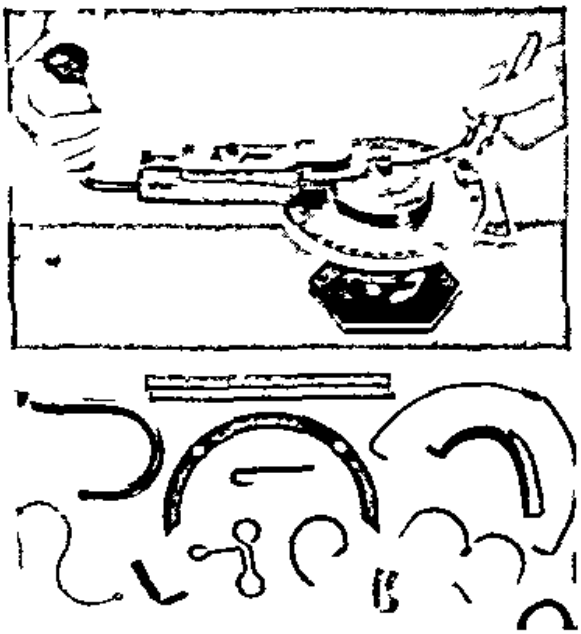


Playing a piano fitted with the new solo attachment. Electric parts are concealed beneath the piano

Stops on the special keyboard below give the solo part a tone quality like that of various instruments



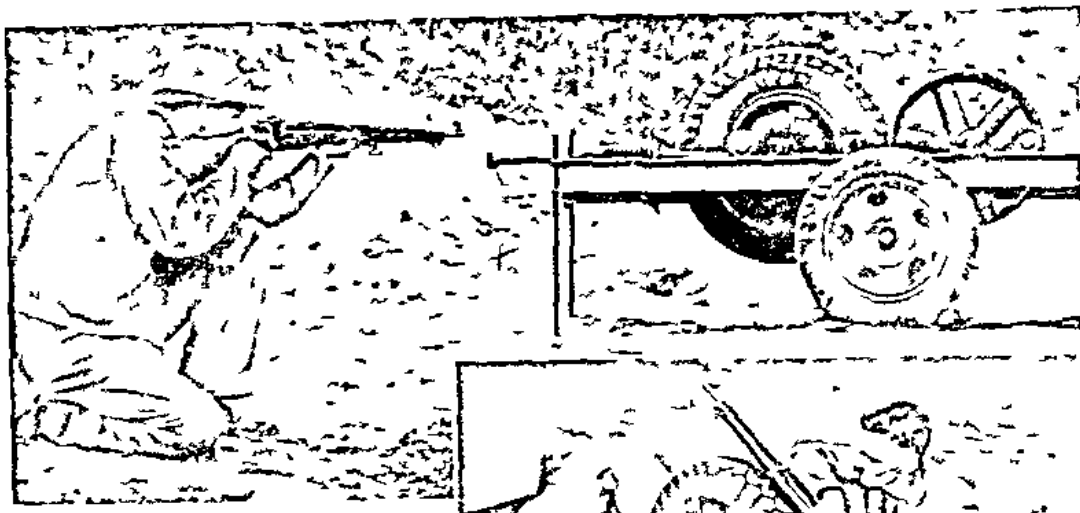
FITTED to any piano a new attachment makes it sound as if two musicians were playing an instrumental soloist and a piano accompanist. To render the melody one note at a time the player uses a bank of thirty six keys mounted beneath the regular fingerboard. Organlike stops give this solo part the tone of brass wood wind, or stringed instruments at will. Meanwhile the performer fingers the accompaniment upon the usual keys. A knee lever controls the volume of the solo tones which are produced in vacuum tubes and made audible by a compact loudspeaker. With the attachment at one end of the keyboard two persons can play a duet.

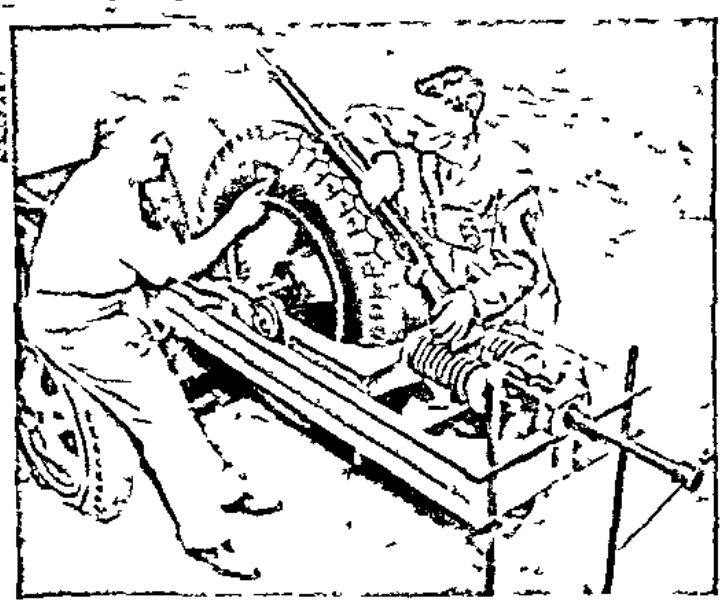


The hand bending tool in use and some of the parts made with it. A six inch rule gives size comparison

Novel Hand Bending Tool Shapes Metal Accurately

TO AID in filling small orders of from fifty to 300 duplicate parts without the trouble and expense of making forming dies a Minneapolis, Minn., mechanical products firm sought a universal hand forming machine. Finding none on the market its craftsmen designed and built one of their own. When neighboring shops clamored to borrow or rent the original model, the Minneapolis concern decided to manufacture it, and now it has become one of their leading products. A precision bench or vise tool it bends round or square rods and tubes, wire and strip stock to curved or irregular shapes with 1/1 000th-of an inch accuracy and much saving of material





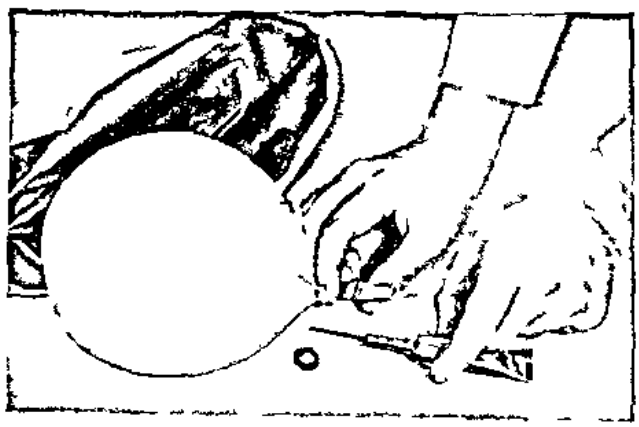
Examining a tire after rifle bullets had been fired into it as shown above in tests at the Aberdeen, Md., proving grounds

Bulletproof Tire Heals Own Wounds in Army Tests

FIRED point blank into the tread of a new military tire, bullets from army rifles and machine guns recently provided a spectacular demonstration of the ability of newly devised triple-layer inner tubes to seal themselves when punctured The tires, developed for use in the United States Army by laboratory workers in Akron, Ohio, are expected to prove valuable on gun carriages, antiaircraft gun mounts and machines of motorized cavalry Three layers of special rubber compounds, one of which is semiviscous, give the new tires their ability to 'swallow bullets without being punctured The inner tubes formed of these layers seal themselves without appreciable loss of pressure when they are pierced by bullets At the famous Aberdeen proving grounds, in Maryland, Army officers fired 50 and 30 caliber bullets into the tires One tire pierced by 50 caliber machine-gun bullets, continued in service for 200 miles without additional inflation.

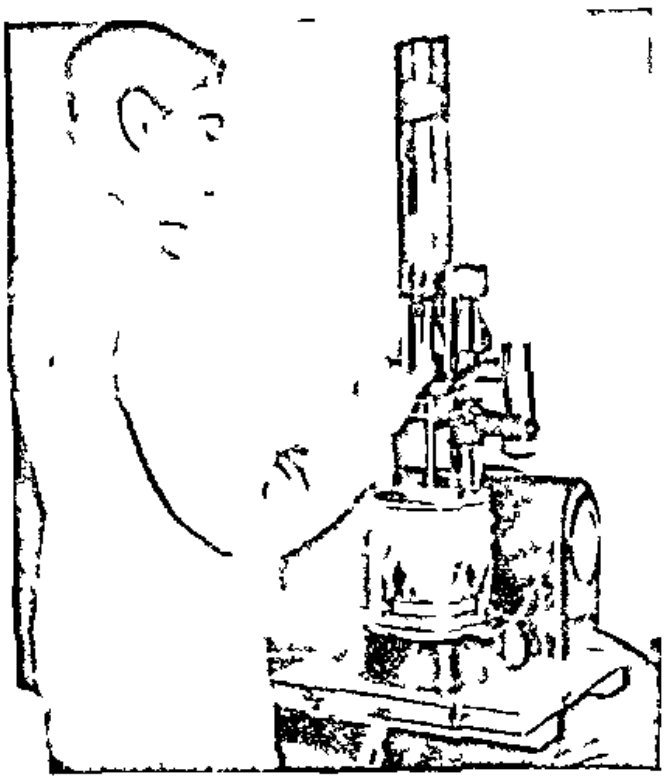
Latex Injection Kit Repairs Leaks in Ball Bladders

WITH a compact repair kit just introduced by a Los Angeles concern, anyone can repair small leaks in beach balls, basketballs and footballs The kit consists of a tube of specially compounded liquid latex and a hollow needle through which the fluid is forced into the interior of the bladder The latex is reported to seal a small puncture in a few seconds The whole job of repairing a punctured bladder is said to be accomplished in about one minute As soon as the latex has had time to fill the hole, the ball is as good as new and can be pumped up and put into use again



A hollow needle is used to force latex into the bladder

Paint Mixer for Stores Blends Colors To Suit Buyers



This device mixes blending hues with the paint in a can

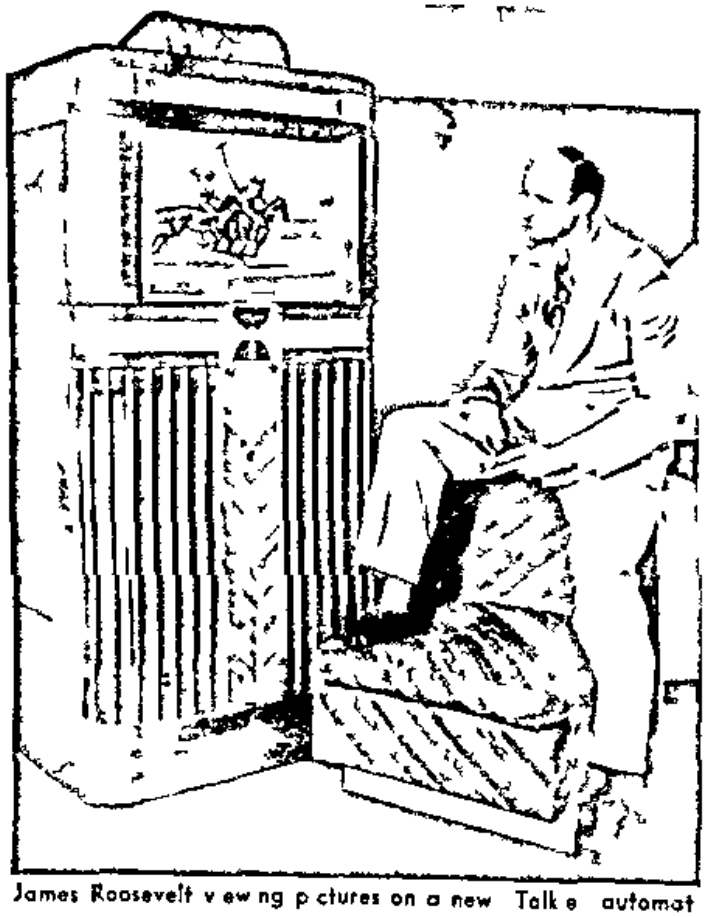
CUSTOM MADE paint of any tint that a customer may fancy can be obtained from stores using an ingenious new mixing system. A dealer need keep in stock only a few standard colors of base paint in cans These are supplemented by cartridgelike tubes containing blending hues Without removing the main lid of the special can the contents of any cartridge may be injected through a small auxiliary opening and an electric agitator thoroughly mixes the blend in two minutes time Thus a shopkeeper can offer a selection of several hundred colors while keeping his store space and inventory to a minimum

Synthetic Glycerin

GLYCERIN, commonly obtained as a by product of the soap industry can be produced in sufficient quantities from petroleum to meet any wartime requirement according to chemists of the Shell Development Company

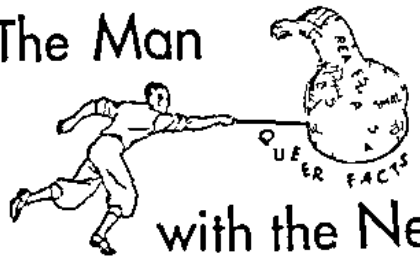
New Slot Machine Shows Sound Films

SOUND-MOVIE cabinets operated by dropping a coin in a slot and quickly installed anywhere offer a new form of entertainment for railroad stations lunch rooms and other public places Sponsors of half a dozen makes already in use or nearly ready for production expect them to compete in popularity with the coin operated phonographs now in vogue A typical model is shown at right with James Roosevelt son of the President watching one of the reels his film company has made for it Using sixteen millimeter film it presents a three minute program the pictures being projected on a small screen at the front One maker proposes a more ambitious sort of installation From a suitably located cabinet in a restaurant a system of mirrors would convey the images so that they could be viewed by occupants of every booth in the establishment.



James Roosevelt viewing pictures on a new Talkie automat

The Man with the Net



FILES *of the Federal Bureau of Investigation contain 250,000 nicknames used by criminals They range from Carbolic Kid and Izzy the Eel to Slow Town Blackie and "Boo Boo Hoo Hoo*

ADDERS *have an antidote for their own poison in the bile of their gall bladders*

DESERT TURTLES *of the Southwest sometimes swallow enough water in a single drink to increase their weight forty percent*



ICE CREAM *factories in this country use more milk annually than 1,000 000 cows can produce*

KING CRABS *have blue blood*

HORMONE SPRAYS *now prevent apples from dropping from trees before they are ripe*

CARBONATED *soft drinks were used in America as early as 1807*

RATTLESNAKE SKIN *neckties are being sold in a Broadway store in New York City*



CARRIER PIGEONS *with a natural camouflage of mottled plumage are being bred for wartime use*

SYNTHETIC RESIN *made from cactus is a new product reported from Mexico*

GASOLINE *has an explosive power more than eighty times that of dynamite*

RACE HORSES *in the United States are not permitted to have more than fourteen letters in their names*



Kitchen Utensils Lend a Hand in Odd Music of Cowboy Band

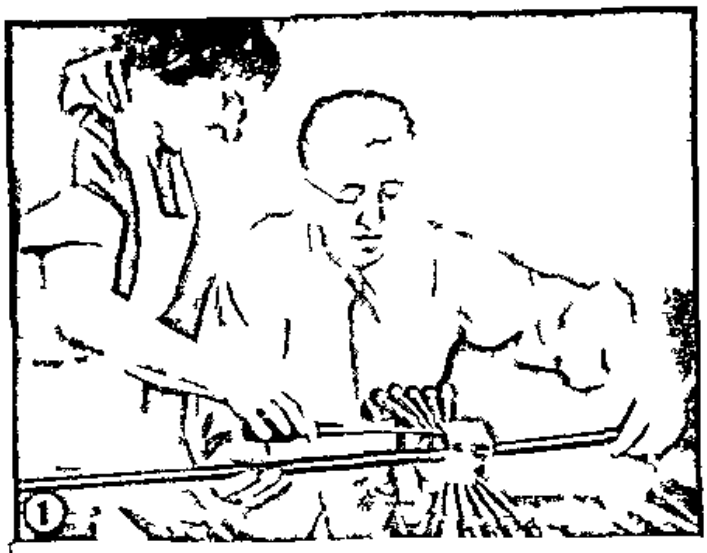


Coax ng a tune from a cheese box v ol n and below a washtub bull f ddle

RESIDENTS of Yermo Calif dance to the wailing and thumping of strange instruments in the hands of a five piece cowboy orchestra With a bent arrow and string for a bow one performer plays a violin made from a cheese box Another alternately bows and thwacks a bull fiddle constructed from a washtub a string and a broomstick By pulling against the stick he obtains a variety of more or less musical tones



Here s the full orchestra El m nat ng the p ano how many fam l ar art cles do you recogn ze n it?



Robert Howe l beg ns a del cate p ece of Bohem an g a s b ow ng by soften ng a tube of colo ed glass H s w fe holds a p ne block to reflect heat of gas f ame



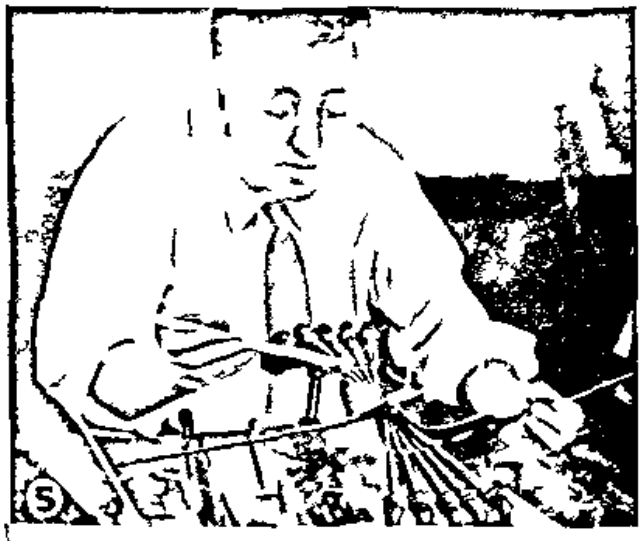
Afte d aw ng out the tube at both ends to fac ta e blow ng the a t st makes a small bubble at one end



By KENNETH M SWEZEY

Glass-Blowing

BLOWING bubbles in glass has brought internat onal fame as well as a modest fortune to the Howell fam ly of Union N J Touring the length and breadth of the Un ted States in a housecar contamng a complete glass working shop they have given thousands of demonstrat ons before colleges schools and clubs of a del cate and beautiful art that dates from before the



By d aw ng out the wh te glass the ears and antlers a e g en the de ed shape Howell now adds the t ny p ong to the ho ns by the use of mo e wh te glass



A leg s attached n the same manne as the horns Ext eme heat cau es the ed of the body to m x w th the wh te of leg



As the bubble s stretched t beg ns to take shape as the neck of a graceful f g ure of a deer Head s formed by pul ng



To make the ears and antlers a rod of wh te glass s heated and touched to the s des of the head Howell keeps on blow ng to prevent the head f om collaps ng

Family WINS FAME IN ANCIENT ART

beginning of the Christian Era When they are not traveling the Howells work long hours over hot gas fires in the cellar of their New Jersey home creating vases animals birds flowers and other decorative knickknacks of glass to fill waiting orders from all over the world

Robert Howell the father began his glass blowing career in his own home when he was in his teens blowing thermometer bulbs and laboratory equipment which he sold to a chemical supply house Soon he was engaged to demonstrate glass blowing to crowds at the Chicago World s Fair o'



After add ng a ta l Howell exam nes the legs care fully to make su e that the f gu e w ll stand p oper ly The next step w ll be to pull off the long nose



A tr angle bent f om crystal rod s fused to the feet to serve as a base The com pleted f gure is seen on the oppo te page





Crocheted glass candelabra and ship model made by Mrs. Howell shown at work at the right. Upper right examples of Bohemian glass blowing done by the Howells

1893. When he married his wife also learned the art and the two went forth as a glass working team. Then came the children — two girls and two boys — and each of course became a glass blower. During forty-six years of exhibition including a spectacular engagement at the 1939 New York World's Fair the Howells have instructed and fascinated literally millions of persons in the secrets of this ancient art.

The Howells specialize in Bohemian glass blowing, so called from the fame given it by the craftsmen of Bohemia. It consists in shaping all sorts of delicate objects from thin glass with the use of only the simplest tools and without any kind of molds. Original stock comprises glass tubes and rods of various sizes and many brilliant colors. One of the most expensive types of this glass is the beautiful ruby glass which owes its color to a salt of pure gold.

Besides skill and a keen artistic sense the chief requirement is a hot, steady and sootless fire. Howells fires come from specially built gas burners fed with air from a motor blower and capable of producing a temperature above 3,300 degrees Fahrenheit. In working large pieces the heat is concentrated by using reflecting blocks of white pine.

All blown work begins with a tube of glass of the desired color and size. This is heated to the required softness—determined by the feel and color of the glass—and is expanded by blowing gently into it, and lengthened or contracted by drawing it out. Beauty and elaborateness of a piece are determined only by the skill and imagination of the worker.

Crocheted glass is a special type of glass working that has been developed to a high degree of perfection by Mrs. Howell. Pieces of this work, ranging from little glass baskets and candlesticks to elaborate candelabra and model sailing ships, are built up loop by loop with yarn drawn from the end of a rod of crystal glass.

Bridge's 2,700 Lights Keep This Man Busy

COMBINING the jobs of human fly electrician and lamplighter John J Kiernan watches over the 2 700 electric lamps which light the great George Washington Bridge across the Hudson River In his work of inspecting equipment and replacing burned out bulbs he climbs cables rides along wires in a bo sun s chair dangles high above the river at times more than 500 feet in the air His day begins with an in spection of the aircraft warn ing lights at the top of the great towers it ends with an exami nation of the countless naviga tion lights dotting the anchor age piers In between the steel nerved Kiernan walks miles uphill and down on the monster metal cables which support the 3 500 foot span To guard against sudden gusts carrying him from these gigantic tight ropes he loops a safety belt over outrigger cables sliding it along as he advances A veteran steeple jack electrician Kier nan has been keeping the bridge lights burning since 1931

John J Kernan dons h s safety belt for h s da ly inspect on of the l'ghts on the Geo ge Wash ington B dge The other v ews show h m at wo k on huge cables h gh above the Hudson R ver

Violins FROM SCRAP WOOD . .



Samuel Stochek ma k ng a p ece of salvaged wood wh ch w ll eventually become pa t of a f ne v ol n A standa d form s the pattern



Search ng old houses for good wood he tests l kely look ng p eces w th a kn fe and plane

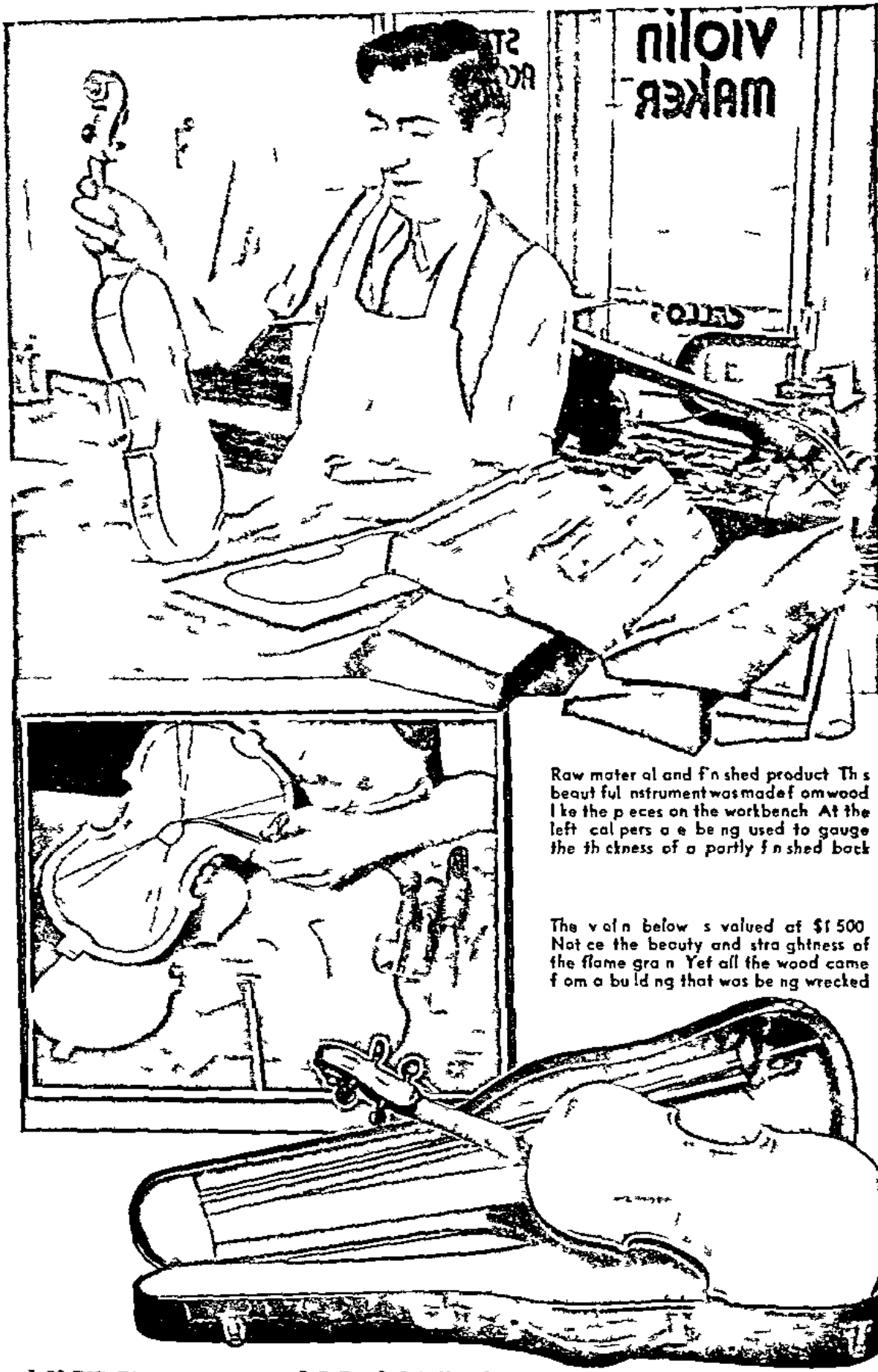
BEAMS doors and shelves from old houses supply Samuel Stochek *New York violin* maker with raw material for a fasci nating craft His skilled workmanship transforms the seemingly worthless bits of lumber *into exqu site* hand made violins valued at up to $1 500 apiece

As a buff follows fire engines so Stochek trails wreckers demolishing outdated build ings Friends help keep him informed of fresh hunting grounds His object is not primarily to save money for in these places he finds the kind of lumber he likes best. After fifty years or more of seasoning the wood is just right.

A lucky collecting trip to some half demol shed house may yield him a perfect slab of quarter cut flame grained maple which will make an ideal back—the resonating part—for a fine violin Other game includes spruce for the top or sound board. Armed with a knife and plane Stochek probes each likely *looking* piece to test the cut color and grain If the wood is yellow on the outs de but white under neath it has not aged sufficiently Deep pene tration of the surface color *indicates long* sea soning Shavings of old wood crushed in the hand disintegrate into fine fragments newer wood is more cohesive Too fine a grain will make for undue *loudness* while grain that is too wide will detract from brilliancy of tone

Back in his shop with his trophies Stochek begins the task of shaping the pieces Delicate *gouging and planing* constantly checked with calipers thins a curved back until it is slightly transparent when held to a strong light. A single one of these pieces may take him a month to complete Other parts are assembled and after numerous coats of special varnishes and stains the violin is ready for use

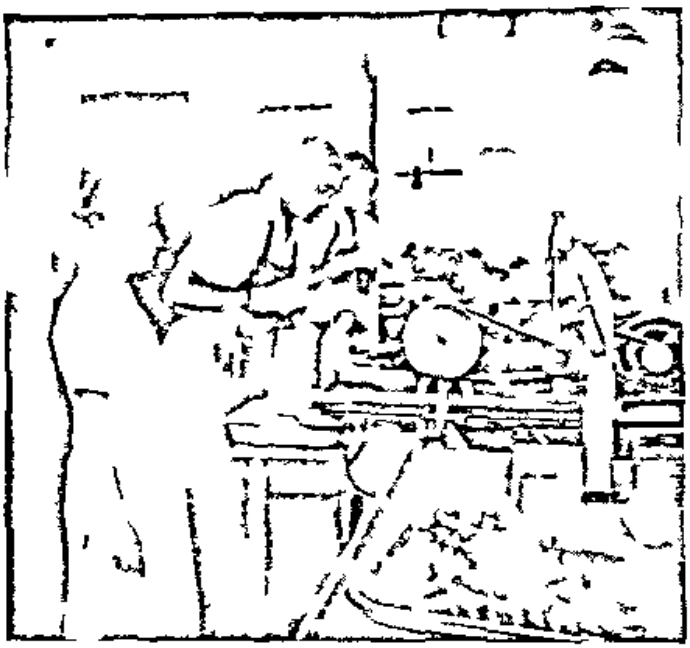
Stochek himself plays the violin ably but he likes even better to make one It gives him a thrill to fashion from a floor joist that has resounded to the steps of thousands of people a beautiful instru ment that *can sway the emotions* of other thousands



Raw mater al and f n shed product Th s beaut ful nstrument was made f om wood l ke the p eces on the workbench At the left cal pers a e be ng used to gauge the th ckness of a partly f n shed back

The v ol n below s valued at $1 500 Not ce the beauty and stra ghtness of the flame gra n Yet all the wood came f om a bu ld ng that was be ng wrecked

WHERE HEALTH IS

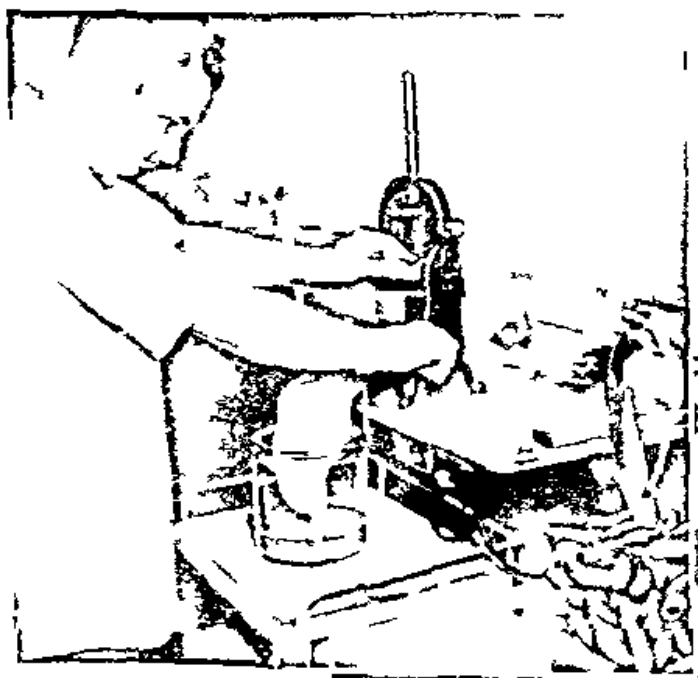


A cene n A G Ba fou s labo atory at Englewood N J whe e med c nal ju ces a e ext acted f om st ange sou ces

Rx SIX OUNCES of grass juice Prescriptions such as that are all in the day s work for Abraham G Balfour Fresh bottled grass juice which is sa d to vie with spinach as a source of calc um and vitamins is but one of more than 700 varieties of fru t and vegetable ju ces and the r blends which he produces in his Englewood, N J laboratory His un que factory is running twenty four hours a day and shipments of cho ce garden and orchard prod ucts from as far away as Cali fornia arrive at Englewood on a daily schedule

Balfour s unusual business be gan five years ago A d et cian en gaged in vitamin research he be- came interested in the poss b lities of obtaining concentrated vitamin fluids from various plants and fruits Spec al machines, such as a wh rling plate that cuts vegetable pulp into shreds one ten thou sandth of an inch thick, and a press which squeezes out juice with a pressure of eighteen tons have been developed for the work.

Among the most popular prod ucts of the Englewood laboratory in add tion to grass banana wa tercress carrot, and spinach juices,

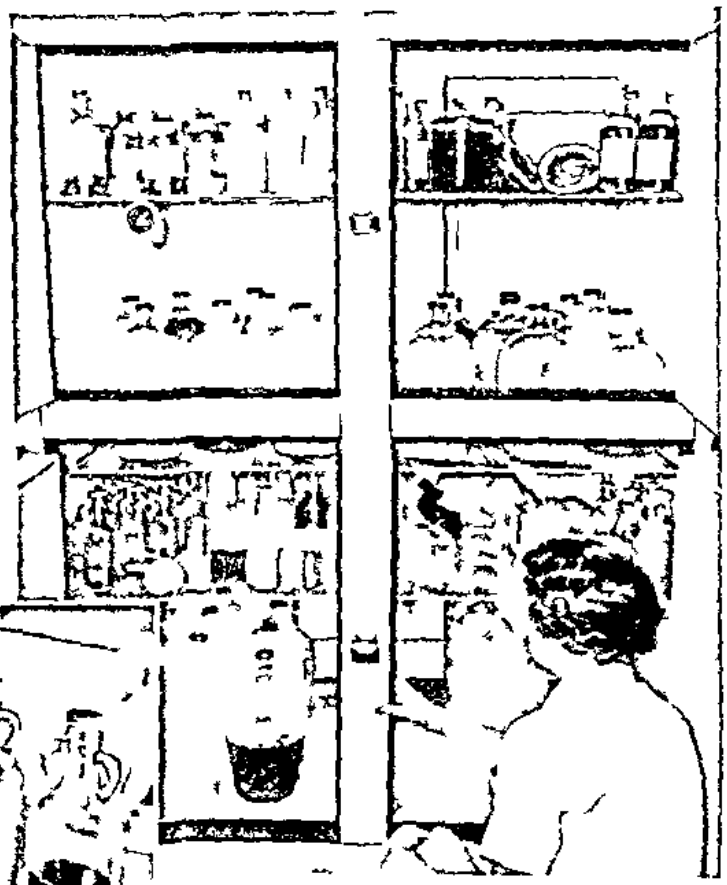




He e Balfou s p es ng ju ce f om a t op cal f u t resembl ng a banana It takes s xty of these l ttle f u t to make twelve ounces of ju ce At the r ght alfalfa s be ng cut up n prepa at on for use

PUT UP IN BOTTLES

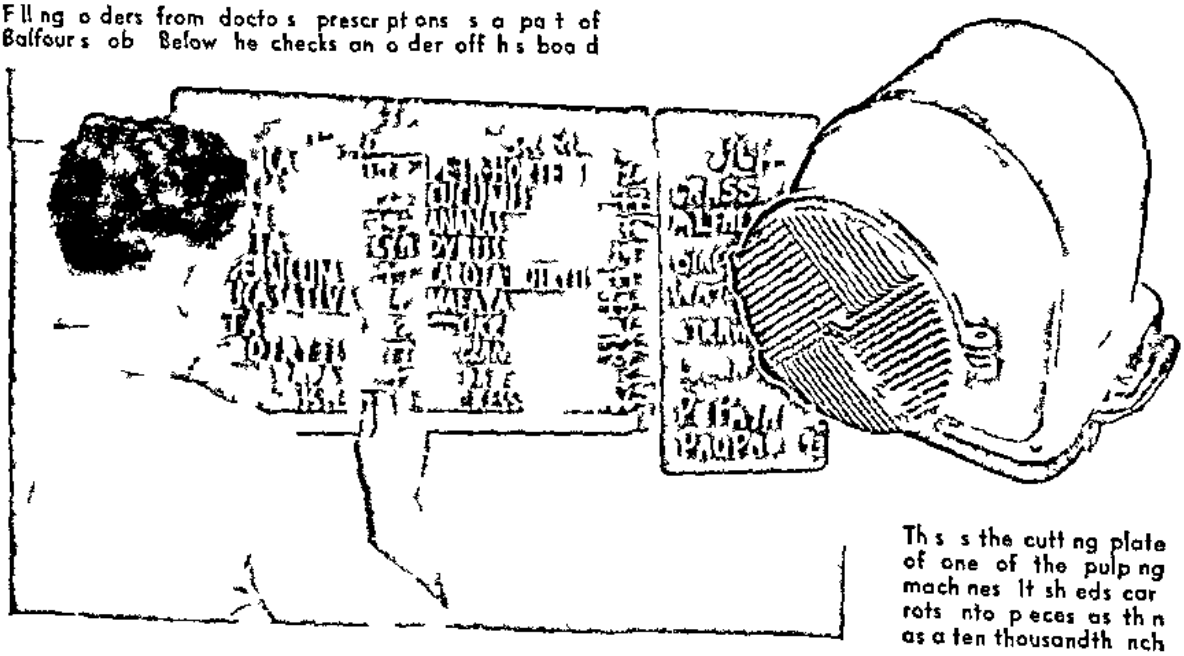
are a combination of tomato and horse rad sh juices and a blend of the fluids squeezed from celery and t mothy hay In various ways by products of the laboratory are turned to profit Orange peels are can died celery hearts are sold to local restaurants cherry skins go to chewing gum manufac turers who obtain from them a waxl ke preservative Customers even from abroad send for Bal four s v tamin juices One man in Zurich Sw tzerland re cently ordered a bottle of h s favorite juice sent across the Atlant c by Cl pper plane The cost was one dollar for the juice and $9 70 for express



After p eparat on ju ces a e placed for a t me n th s ref ge ator cab net All orde s a e del ve ed promptly to nsure f eshness



F ll ng o ders from docto s prescr pt ons s a pa t of Balfour s ob Below he checks an o der off h s boa d



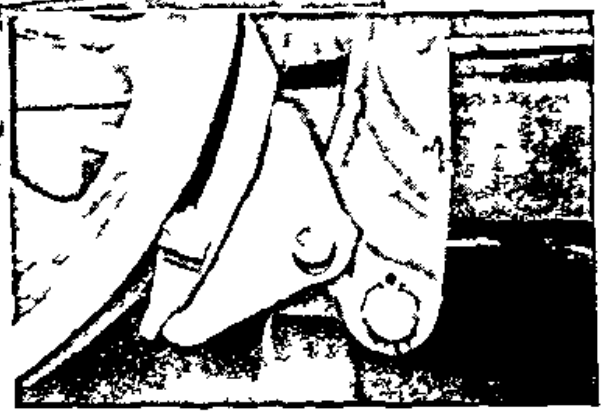
Th s s the cutt ng plate of one of the pulp ng mach nes It sh eds car rots nto p eces as th n as a ten thousandth nch

Locomotive Tires Reshaped Without Removing Wheels



A winch tows the locomotive backward while cutting tools turn down its tires to reshape the worn spots

Oversize blocks replacing brake shoes hold the lathe type tools

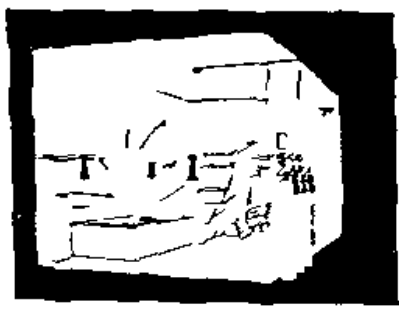


LOCOMOTIVES no longer need be stripped of their driving wheels in a new time saving method for reshaping flat and worn spots Instead, brake shoes are replaced by oversize blocks which hold lathe cutting tools against the metal tires A winch then slowly tows the locomotive backward along the track by a strong cable while the tools do their work. At frequent intervals tests with calipers show the progress made

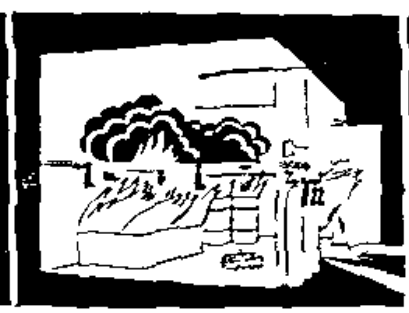
Tried out successfully on heavy mountain locomotives the scheme is said to have greatly reduced the period during which an engine must be laid up for repairs Formerly it took a week or ten days to dismantle the drivers remove the tires turn each one to size and roundness in a wheel lathe and restore the locomotive to service Now only a small fraction of this time is required at a great saving in cost as well.

Factory "Sprinkler" System Uses Carbon Dioxide Gas

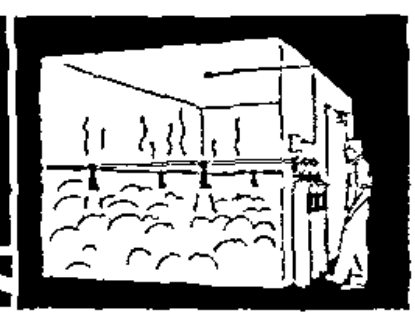
USING carbon dioxide gas instead of water a radically new sprinkler' system automatically smothers fires in rooms where gasoline naphtha, oil, lacquer or enamel is handled Employes have only to rush to safety leaving the fire fighting job to sensitive heat detectors that open the gas valves In pioneer installations designed by *Walter Kidde & Co* of New York, nozzles may be located over small tanks or a whole room may be flooded with gas as doors and windows shut automatically



A "flash fire" starts in a factory room where inflammable liquids are handled Note nozzles

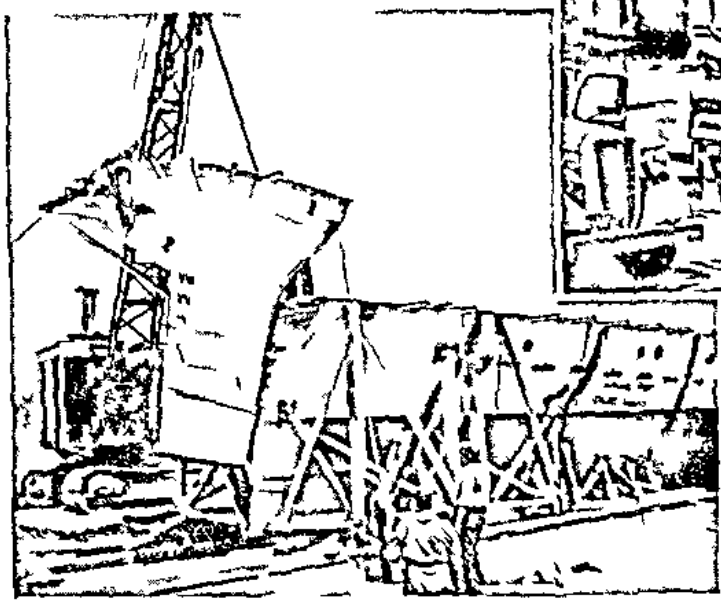


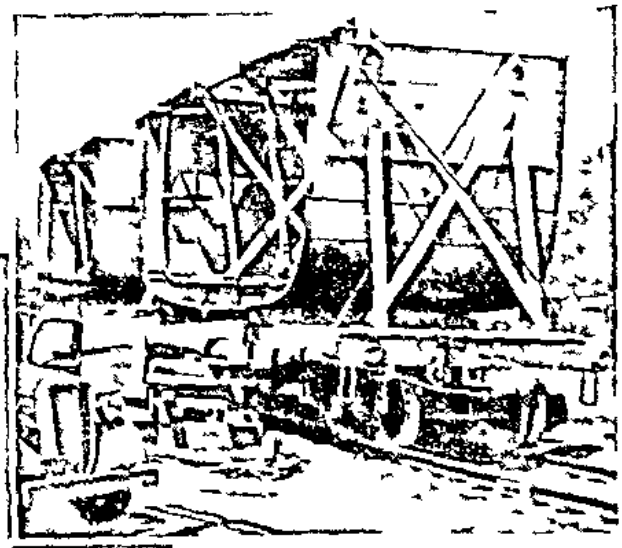
The workman leaves the room as heat automatically releases gas kept under pressure in cylinders



Billowing from nozzles carbon dioxide smothers flames Doors and windows close automatically

Cut into Ten Sections, Boat Voyages Overland on Railroad Flat Cars





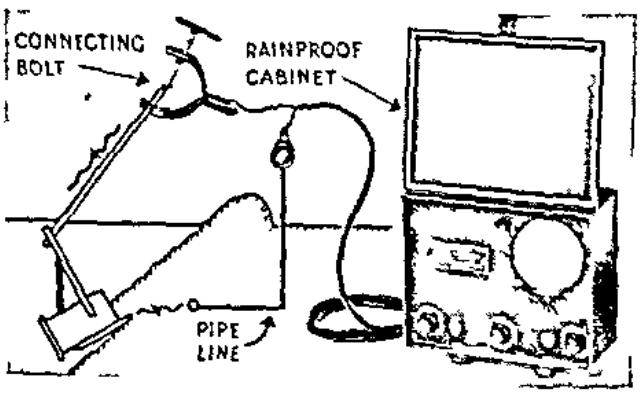
Sections of the Mount Washington II on flat cars for shipping. The vessel is being put together again in view at left

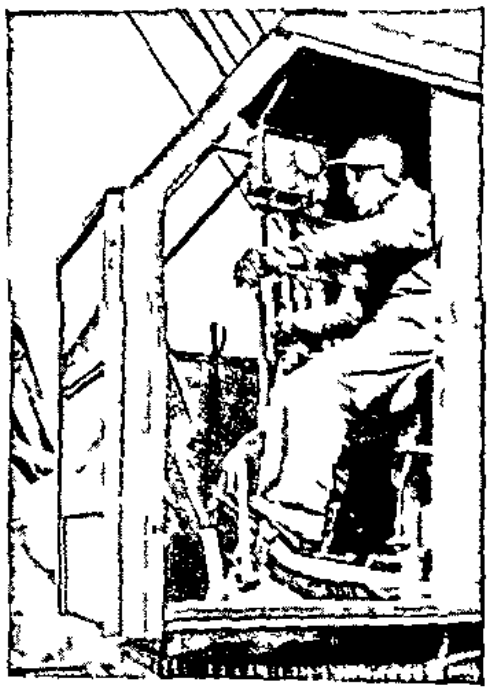
SLICED neatly into ten pieces the 205 foot excursion steamer *Mount Washington II* recently traveled 300 miles by rail from Burlington Vt on Lake Champlain to Lakeport N H on Lake Winnepesaukee

It is believed the largest ship ever transported in this novel manner Welded together after its arrival the all steel vessel was expected to prove even stronger than when it first was built The unusual transfer was made to replace another boat for tourists which was destroyed by fire last winter Accompanying photographs show how sections of the *Mount Washington II* were carried on flat cars and reassembled

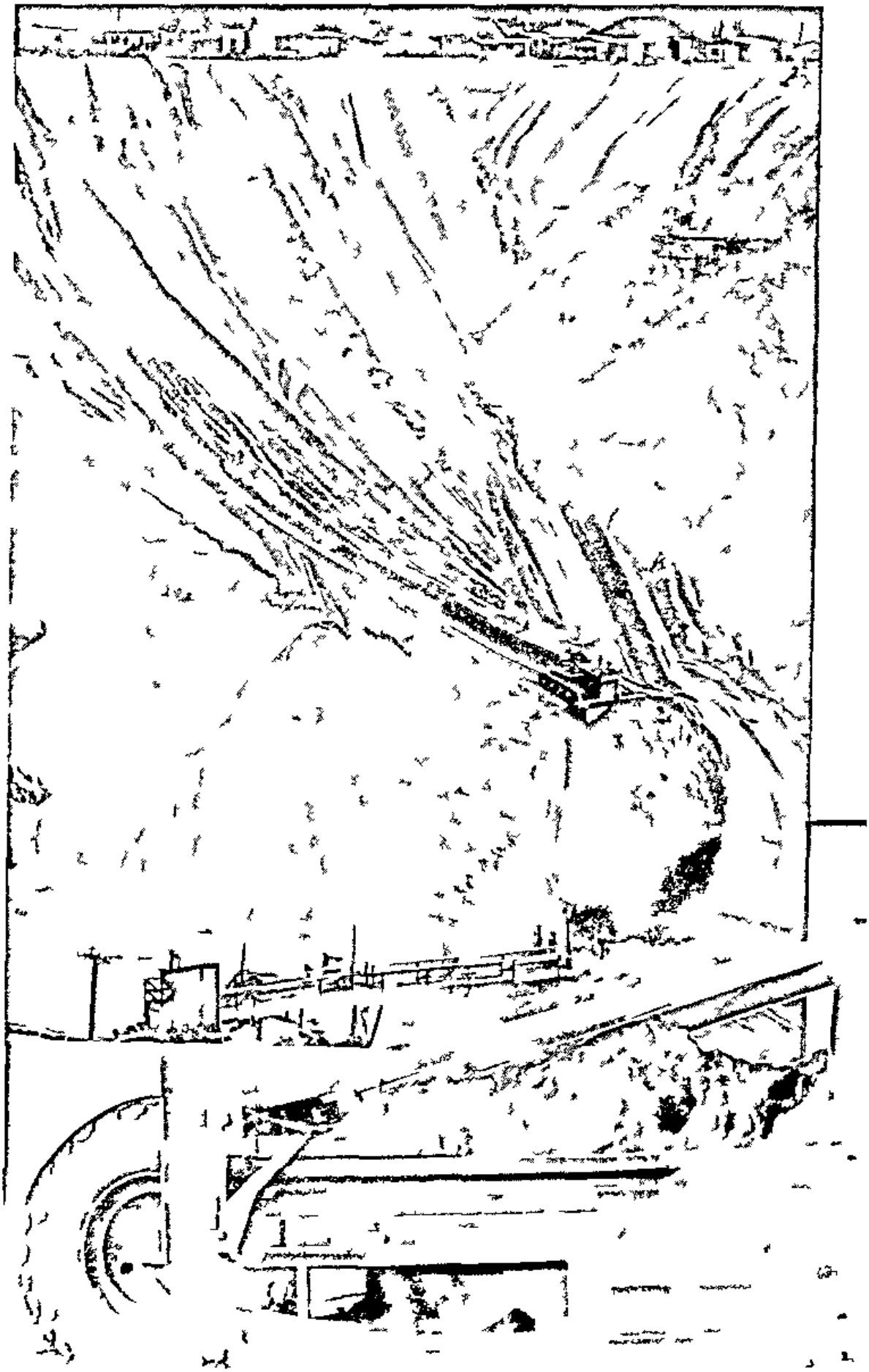
"Pipe Finder" Gives Warning as Power Shovel Nears Line

WEARING headphones a power shovel operator now can excavate right up to a buried pipe or electric cable without damaging it for a warning buzz tells him when to stop Resembling a radio set, the pipe finder is connected to the excavator's frame a battery and any visible part of the conduit A control dial compensates for the difference in electrical resistance of dry wet and rocky soils





If his shovel comes near a pipe line the operator hears a buzz. Illustration at left shows panel and how it operates



Moving the Earth

MECHANICAL MONSTERS HELP BUILD DAMS

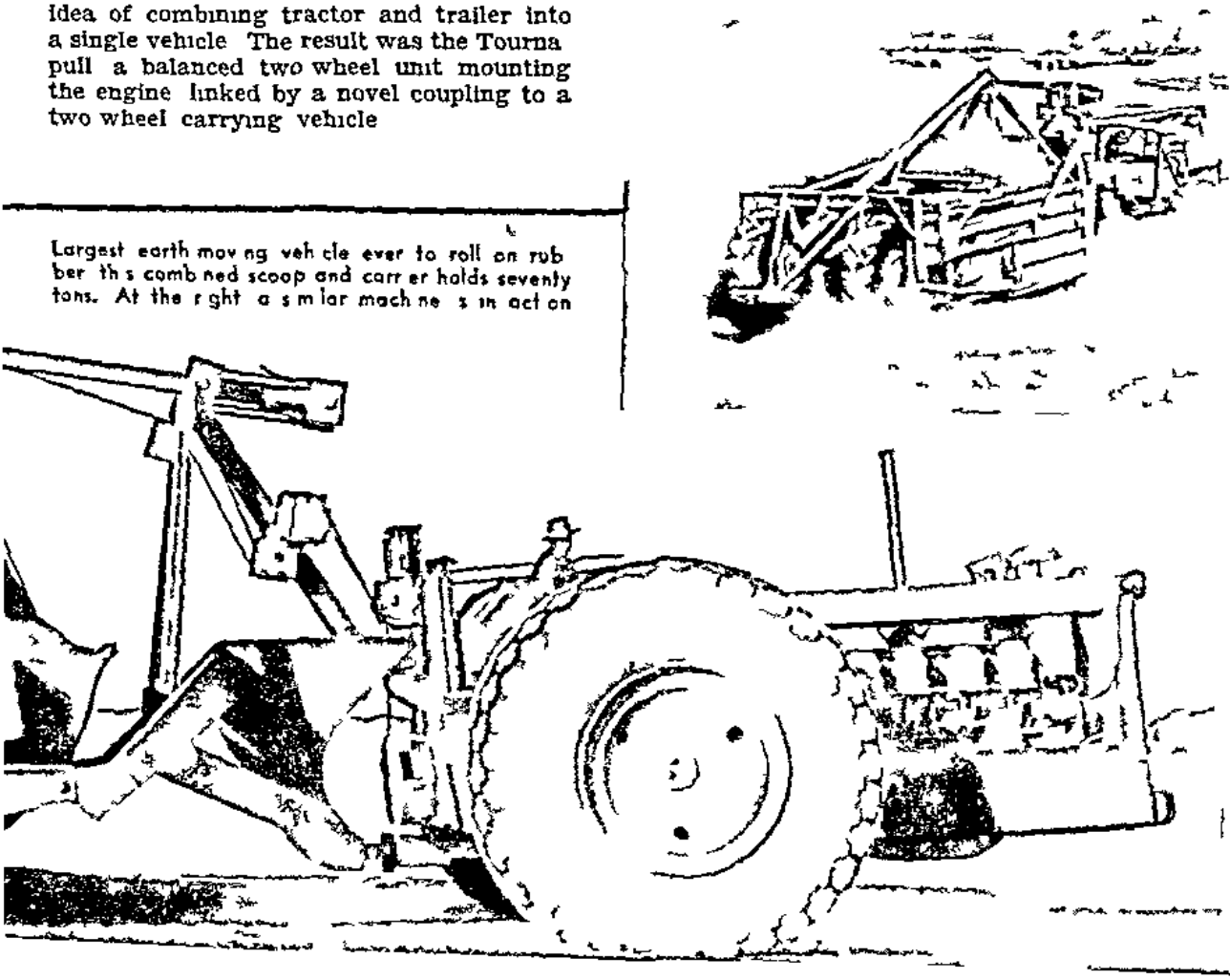
By ANDREW R. BOONE

UP A twisting canyon leading to the crest of California s two mile long Hansen Dam a strange snakelike vehicle rolling on giant tires taller than a man eased to a stop the other day and dumped more than thirty three tons of mixed sand and silt The spreading of that load marked the practical completion of the larg est earth fill structure ever built and ended the first practical test of several ingenious earth moving machines designed to pick up loads that would tax the capacity of railroad freight cars and carry them at speeds of thirty miles an hour across rough ground

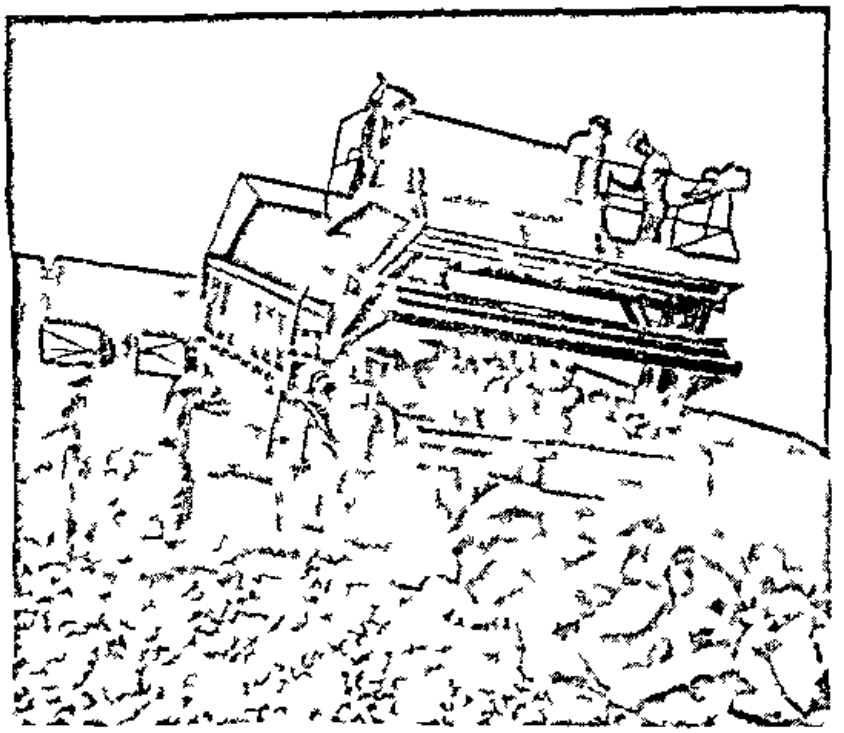
Month by month the men who turn out these mechanical monsters for moving earth surpass their own amazing records Until recently self loading scrapers rolled on four wheels and were towed by tractors Then R G Le Tourneau a wide awake mid western manufacturer conceived the idea of combining tractor and trailer into a single vehicle The result was the Tourna pull a balanced two wheel unit mounting the engine linked by a novel coupling to a two wheel carrying vehicle

Through a system of cables the operator raises the nose depressing the center and causing the scraper to bite into the earth When it s loaded the front gate is closed Raising the center the driver then roars away at a half mile a minute speed

The first of these odd cargo carriers mounted thirty four ply tires weighing 1 500 pounds and hauled forty five tons of loose dirt and gravel—more than a box car can handle Recently Le Tourneau completed a new giant one riding nine foot tires These machines are capable of taking into their powerful steel jaws seventy tons of materials or almost enough to fill two rail way box cars Soon a 150 ton model capable



Largest earth mov ng veh cle ever to roll on rub ber th s comb ned scoop and carr er holds seventy tons. At the r ght a s m lar mach ne s in act on



Hauled by cables up the face of an earth dam a rock spreader depos ts *stone n an even sheet as the load pours out the rear gate over rolle s*

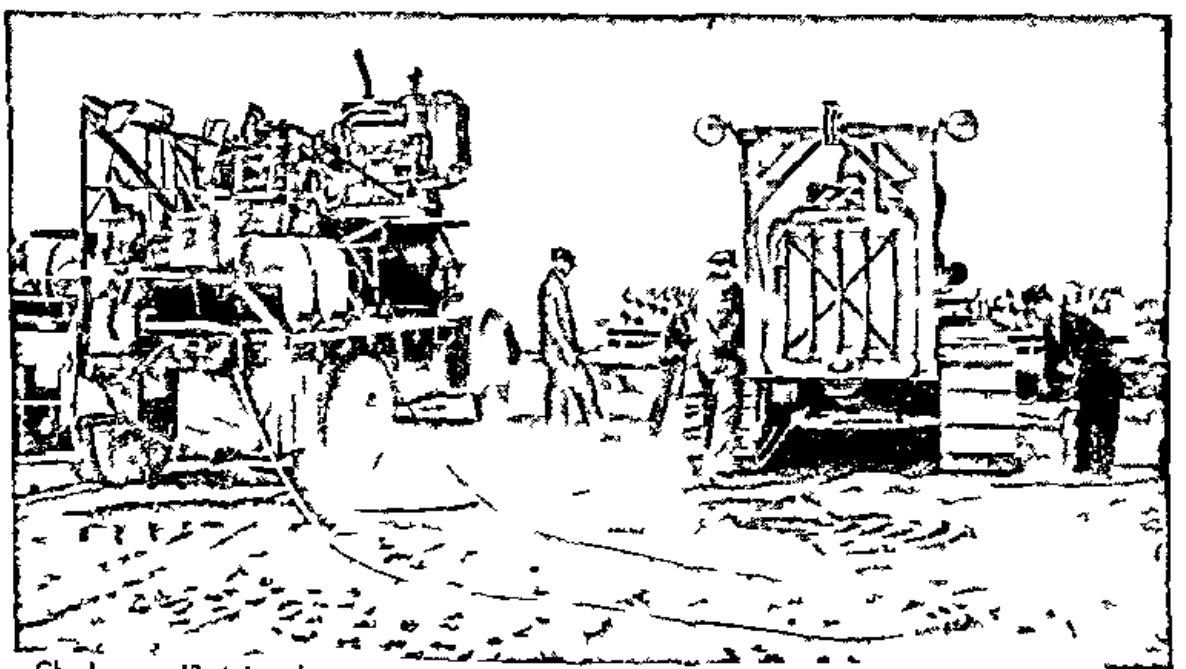
of carrying more dirt than e ghty small trucks will be ava lable

Ne ther spr ngs nor steering wheels have been built into these odd machines Their h gh power D esel engines project in front of the wheels l ke large trunks To turn the operator slips a cone clutch and applies a *brake on one wheel* Engine power de livered to the opposite wheel swings the unit in less than its own length

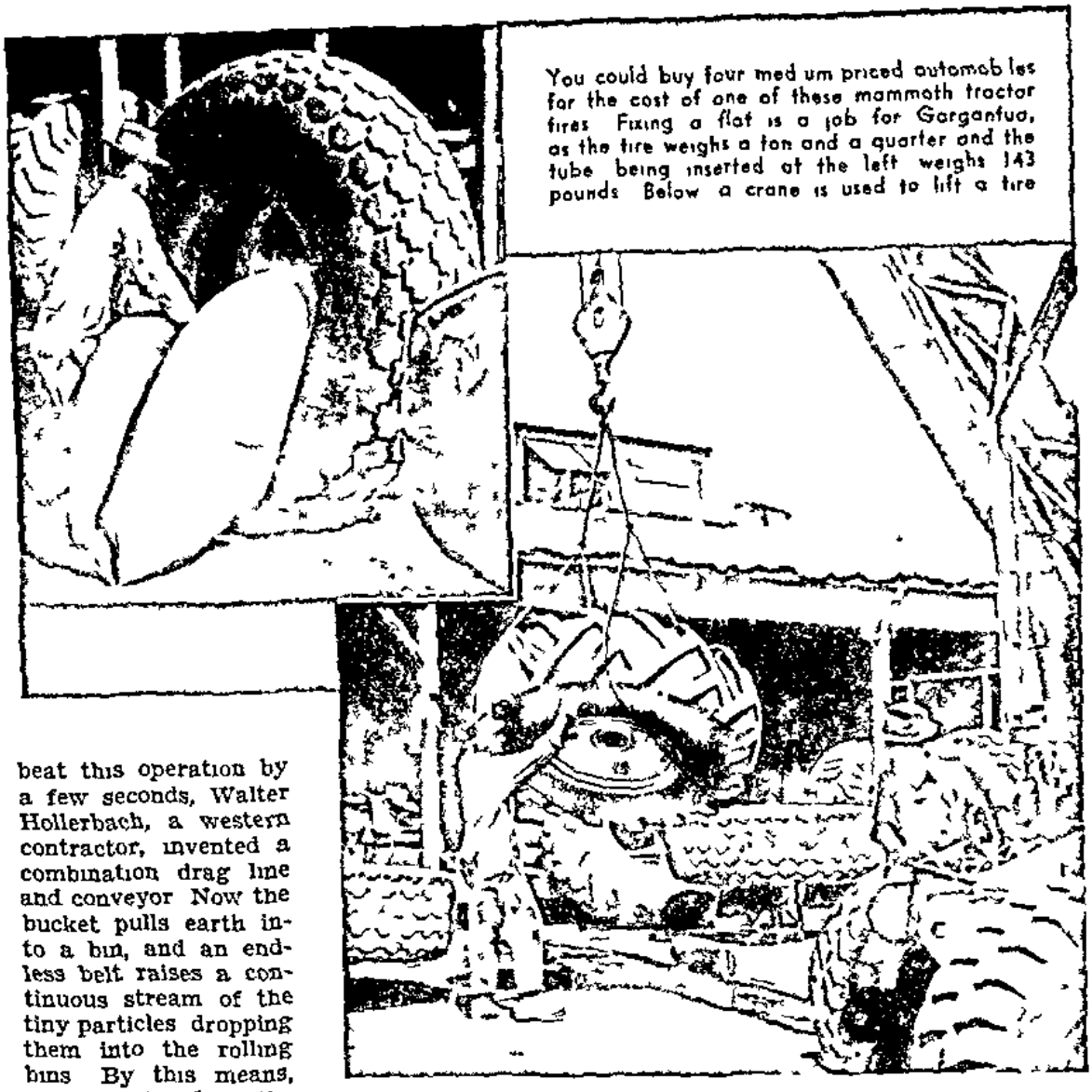
Walk around any of these b g construc tion jobs and you ll see these tractor drawn tra lers bouncing twenty five miles an hour across ploughed fields with tons of loose d rt piled h gh. Whereas trucks must stick to prepared roads these babies can go almost anywhere

Formerly rock was spread over the slopes of dams from trucks lowered by cables En gineers were unable to smear the heavy cover ing to a un form thick ness however so a spreader which distrib utes the rock evenly and to any desired depth was developed. Resembling a large dump truck body the machine is filled by *trucks Held in check* by cables running to an electric crane the skip rolls by gravity to the dumping area There half the load sl des out on rollers as the *machine moves* slowly uph ll Next the front of the body is elevated and the remainder of the load is scattered

The big machines must be kept going day and night to guarantee profits on con tracts running into the millions Formerly long drag l nes would pull in scoops of earth and lift it into waiting trucks To



Check your o l7 A t avel ng se v ce stat on manned by four men keeps the t ucks and t actors roll ng



You could buy four medium priced automobiles for the cost of one of these mammoth tractor tires Fixing a flat is a job for Gargantua, as the tire weighs a ton and a quarter and the tube being inserted at the left weighs 143 pounds Below a crane is used to lift a tire

beat this operation by a few seconds, Walter Hollerbach, a western contractor, invented a combination drag line and conveyor Now the bucket pulls earth into a bin, and an endless belt raises a continuous stream of the tiny particles dropping them into the rolling bins By this means, earth is stored at the foot of the conveyor, moving upward when the operator presses a switch to fill a truck

To keep these valuable machines on the move with a minimum of costly breakdowns and repairs, a traveling service station made its appearance at Hansen Dam not long ago Four men operate the unit In five minutes after swinging into action alongside a tractor or truck, they can fill up the fuel-oil tank check and fill all tires, completely lubricate the mechanism with compressed-air grease guns, replenish the gasoline supply for the starting engine, and fill the radiator On big jobs these trucks move from vehicle to vehicle, to keep the wheels turning without delay

How are flats repaired? It takes three men, pulling at a six foot wrench, to remove a 2 643 pound tire from the axle of trailer or scoop When the casing falls off, it must be picked up by a crane No less than two pairs of hands can pull out the 143-pound inner tube from the giant shoe.

After the heavy tube has been repaired, it again is inserted in the casing, a protecting flap weighing fifty-one pounds shoved into place, and the tire lowered in a cable sling onto the wide rim The tire, held in place by two rings, then is inflated to a pressure of fifty pounds, and lifted against the axle

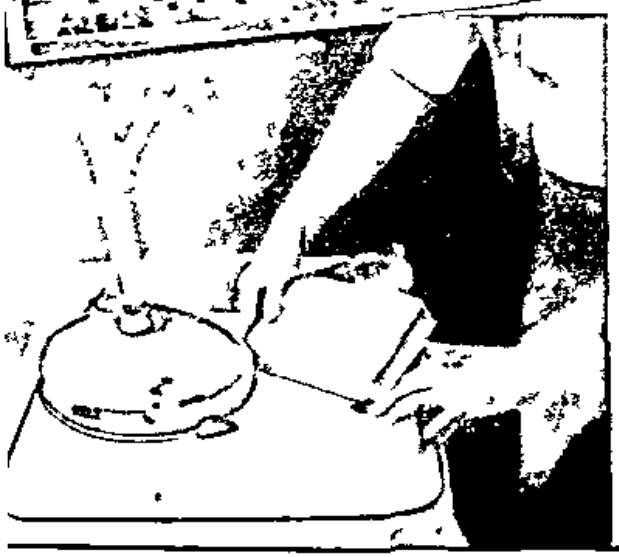
Ready to roll, these tires stand 104 8 inches high are nearly three feet wide, and will carry 41,200 pounds each through dirt and gravel at a speed of twenty-five miles an hour Although they cost $4,285 apiece, including a $375 tube, you can scarcely compare their mileage with the tires on your car, for they seldom roll along a paved highway Regardless of cost, however, men must move earth on rubber, for these tires supply the only springs on their bridgelike vehicles and make possible highway speeds over broken ground

Round the

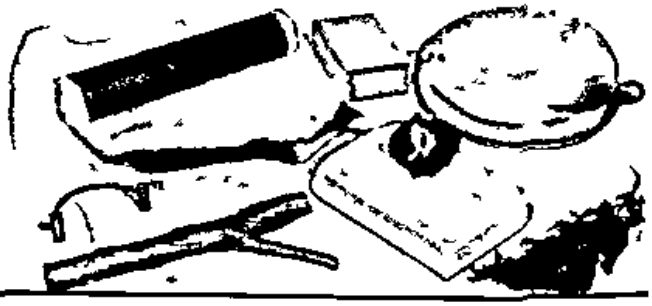


TAKING pictures of places he has never visited provides an unusual hobby for Ernest E Draper, of Scarsdale, N Y Working all day as a commercial photographer, and teaching at night in the School of Modern Photography, he has no time to spare in visiting scenic spots of the world So he does the next best thing, and reproduces them in miniature in his cellar workshop His camera clicks, and he has a photograph simulating a Dutch windmill a street scene in Algiers, a Rocky Mountain landscape, or a diver opening a treasure chest on the floor of the sea Hung in salons, his views have been praised by critics, and show such realism that many a visitor insists he has stood at the very spot portrayed!

Only the simplest of materials,



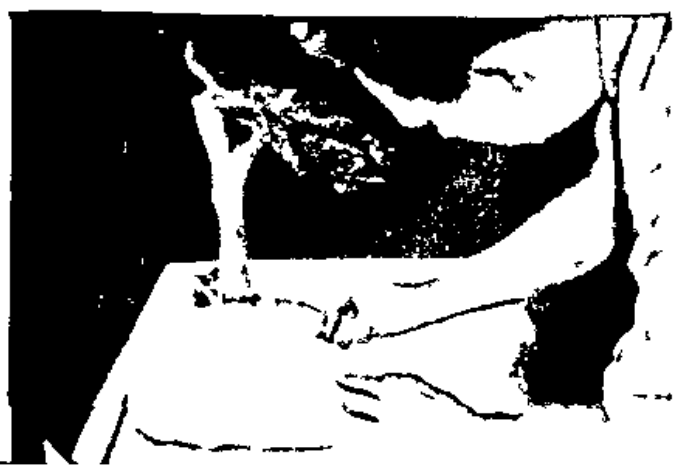
MOUNTAIN SNOW SCENE You may think you have seen the very spot shown in the photo above but you haven t. It is a synthetic setting built up by Ernest E Draper, table top cameraman from the simple materials below



A reflector with a locust twig stuck on it for a tree trunk forms the foundation of a hill which is covered with cotton snow as seen below

For foliage a sprig of arbor vitae is pinned to the tree and more of the same material is scattered about in the snow to represent bushes

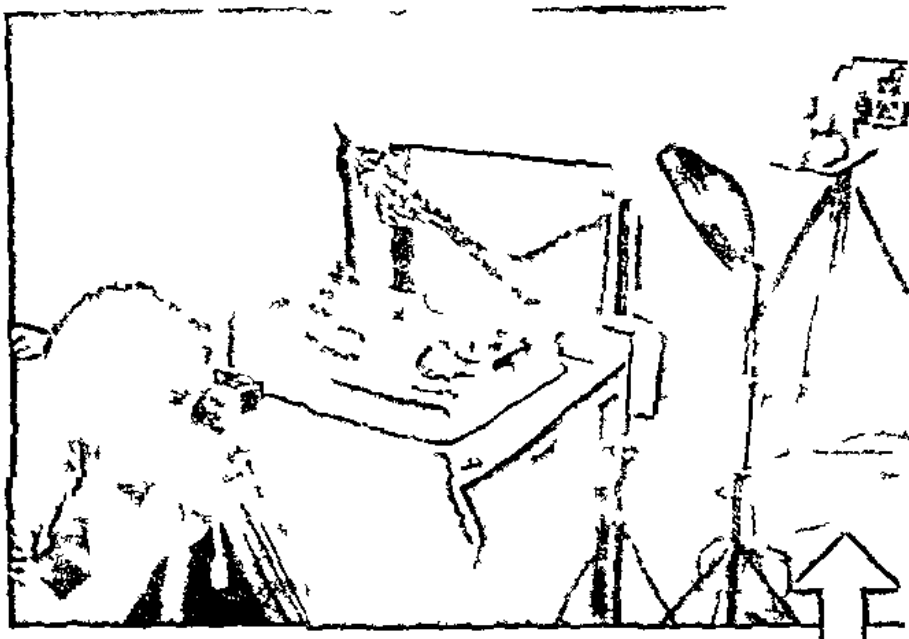




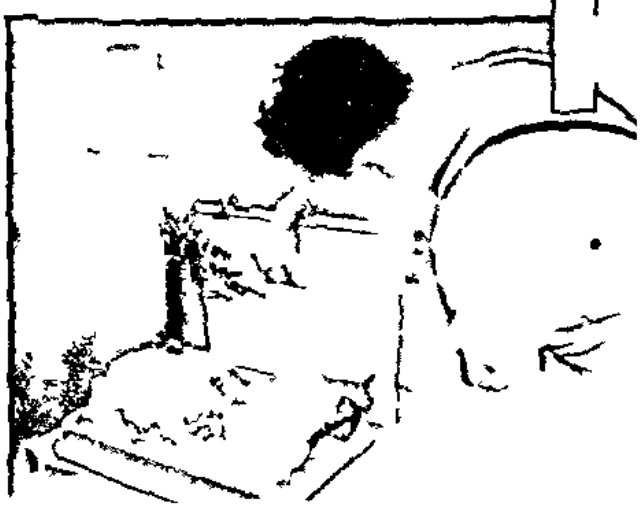
World on a Table Top

available to any camera fan who would like to try his hand at the novel pastime are used by Draper to obtain his striking effects. Because of the enormously reduced scale of the table top scenes various mosses serve well for grass, locust twigs for tree trunks and delicate sprigs of cedar for foliage. Cotton sprinkled with ground asbestos and salt makes convincing snow. Cardboard forms buildings. Modeling clay useful for human figures and various objects also comes in handy for sticking trees and other features in place.

For a background Draper projects a lantern slide upon a back drop of tracing paper. Either a standard projector or a photographic enlarger may be used. Backgrounds may also be drawn, painted, built up or enlarged from actual photographs. A single 100 watt bulb in a simple reflector illuminates the foreground, opposite it a sheet of cardboard acts as a reflector to lighten the dense shadows that it casts.

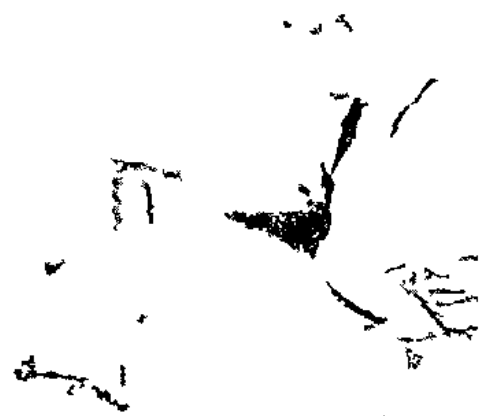


Photographing the finished setting. The background is a genuine mountain photograph projected on a tracing paper screen by an enlarging camera. Note the lighting.



In order that the snow may present the proper texture to the eye of the camera, the cotton is first sprinkled over lightly with ground asbestos . . . after which the whole scene is coated with salt from a flour sifter. Above, Draper sticks cut out birds on glass just back of the tree

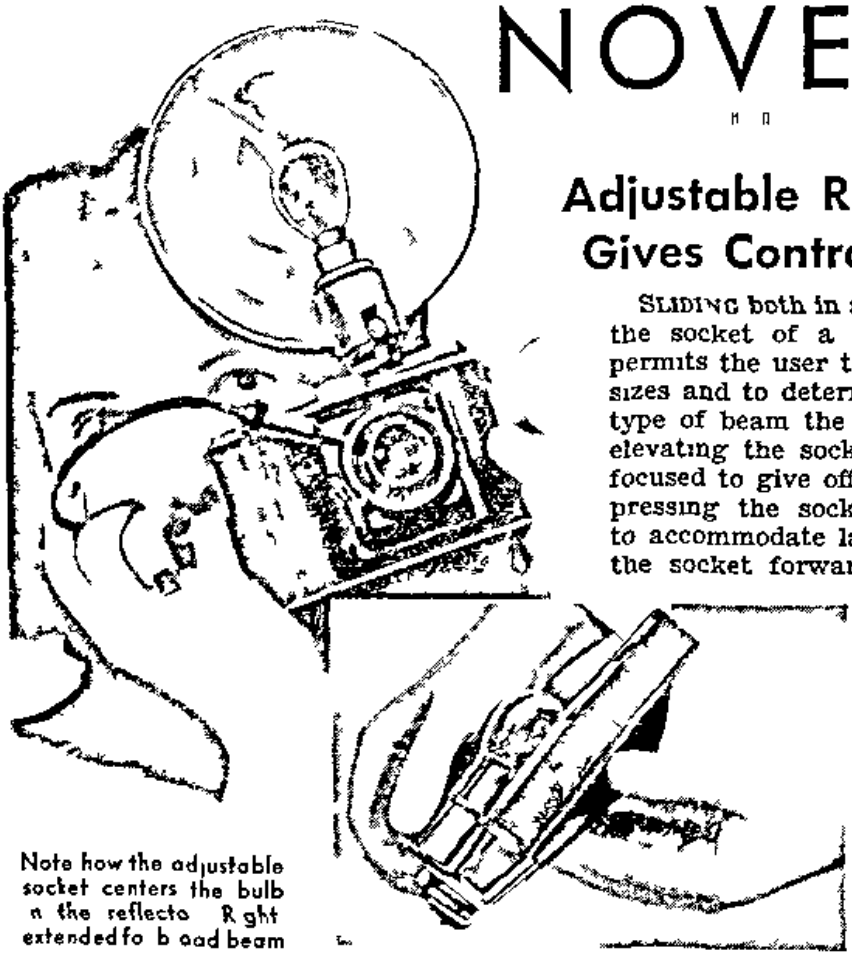




NOVELTIES

Adjustable Reflector Socket Gives Controlled Lighting

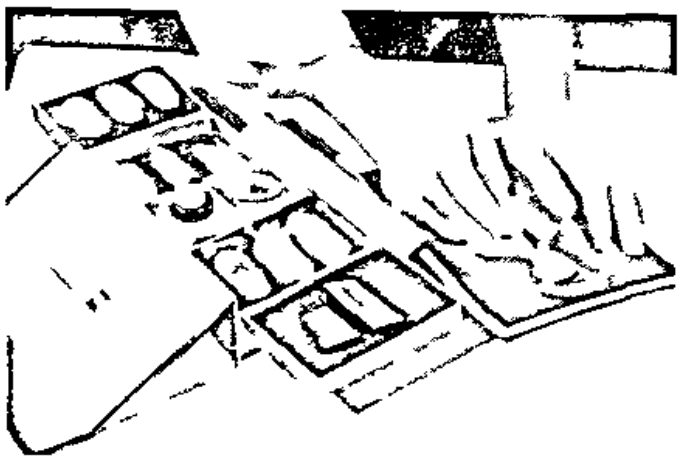
SLIDING both in and out and up and down the socket of a new photoflash reflector permits the user to center bulbs of various sizes and to determine beforehand just the type of beam the reflector will throw By elevating the socket midget bulbs can be focused to give off an even light while de pressing the socket permits the reflector to accommodate larger size bulbs Pulling the socket forward or pushing it toward the reflector governs the width of the reflected beam The nearer the bulb is to the reflector the narrower the beam. Like a convertible lens permitting both wide angle or telephoto shots the new reflector enables the user to ad just his lighting to dif ferent conditions and for various effects



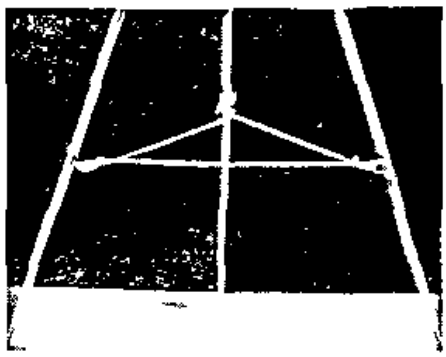
Note how the adjustable socket centers the bulb n the reflecto R ght extended fo b oad beam

Cotton Holds Tints in Color Kit

COTTON BATTING impregnated with colors for tinting photographs is now supplied in kits for the amateur After a bit of cotton is wound about the end of a pointed stick it is dipped in water and the tint is applied to the photograph. According to the manufacturer the colors can be applied to prints of any type surface If incorrectly applied the tints can be eradicated with a chemical solution



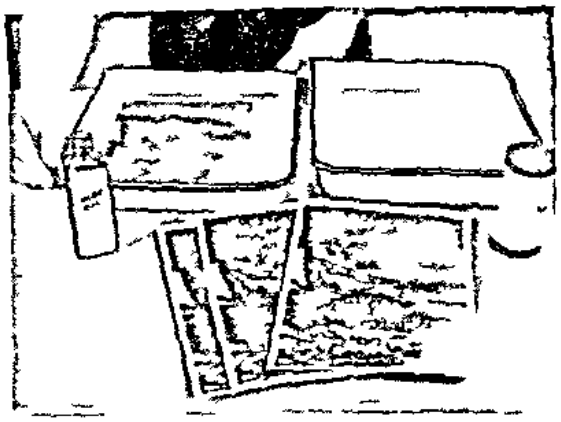
Color mpregnated cotton is wound on a st ck and mo stened



Spring Clamps and Rods Anchor Tripod Legs

TO PREVENT tripods from slip ping when set up on tile or smooth linoleum floors a simple spring-clamp attachment has been marketed by an American manufacturer The clamps which can be adjusted to any position on the legs of the tripod anchor a trio of horizontal metal rods which prevent the legs from spreading on slippery surfaces

FOR CAMERA FANS



Chemical Outfit Tones Prints Without Need of Bleaching

PRINTS can be given a blue brown red or green tone in a single operation by means of a new toning outfit which eliminates the necessity of bleaching the photographs After the print is developed in chemicals that come with the kit it is placed in the toning solution until the desired depth of color has been attained

Photo Album for Enlargements Uses Loose-Leaf Binding

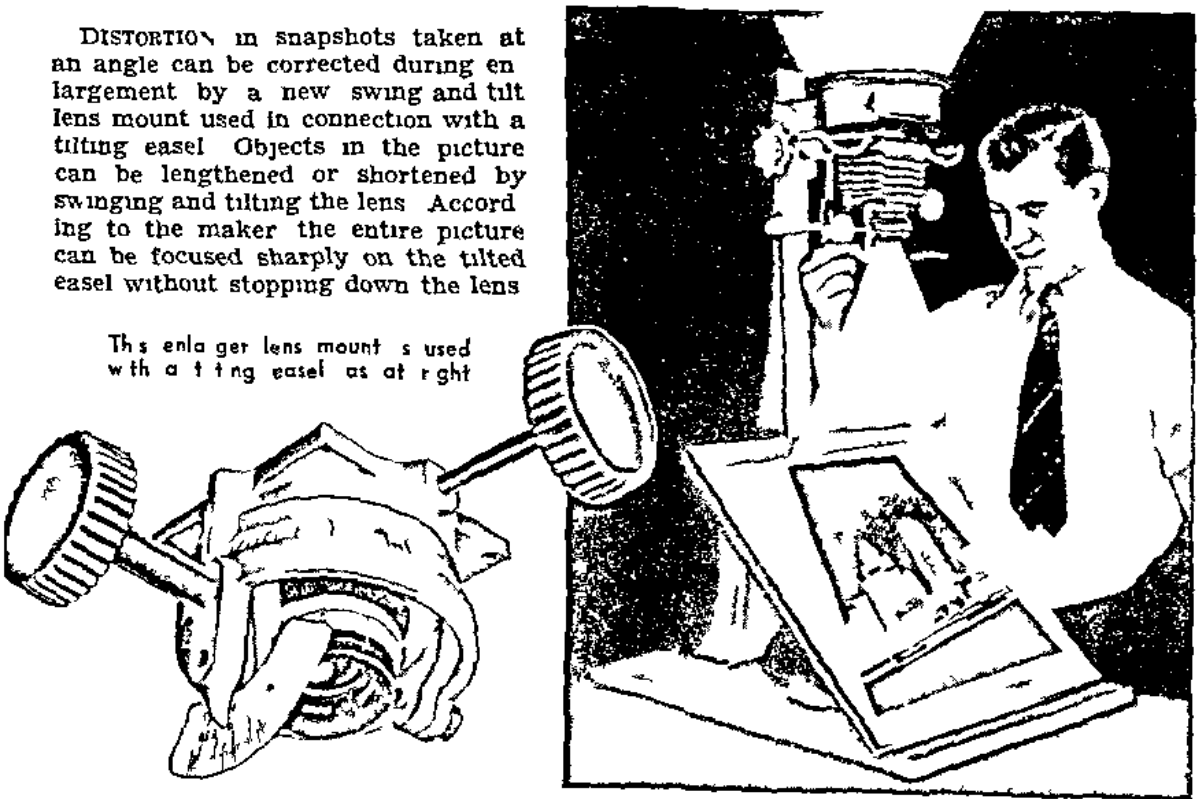
AN ALBUM without pages is a new aid to filing choice enlargements Between covers of transparent plastic material a ring binding holds narrow strips coated with adhesive and protected by a transparent covering To attach an enlargement to the strip the covering is removed



Enlargements are cemented to loose leaf strips

Novel Swing-and-Tilt Lens Mount Corrects Distortion

DISTORTION in snapshots taken at an angle can be corrected during enlargement by a new swing and tilt lens mount used in connection with a tilting easel Objects in the picture can be lengthened or shortened by swinging and tilting the lens According to the maker the entire picture can be focused sharply on the tilted easel without stopping down the lens



This enlarger lens mount is used with a tilting easel as at right

Movie "Tripod" Stands on One Leg



Folded the support rests on a neck strap and fully extended it is set on the ground to steady a camera

FINISHED in black lacquer and polished aluminum, a telescoping metal leg provides a steadying support for home-movie cameras The fifteen-ounce accessory can be supported by a neck strap or on the ground.

Darkroom Trays Identified by Bright-Yellow Corners

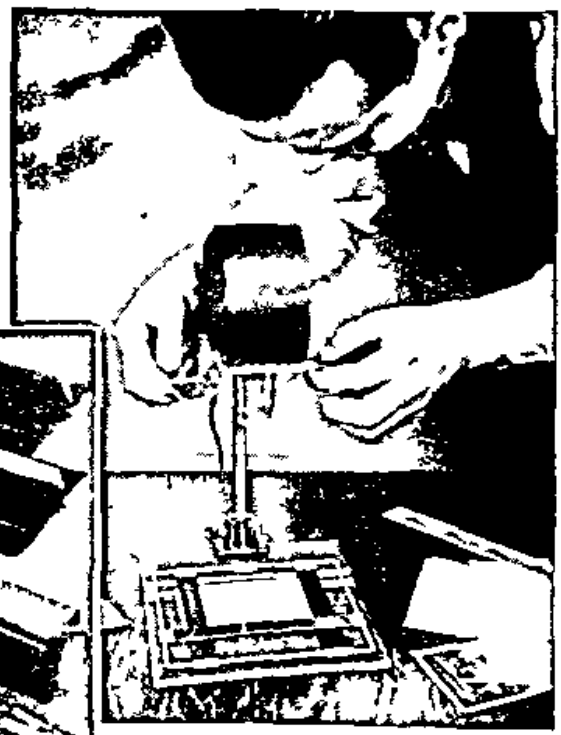
YELLOW corners on rubber coated darkroom trays show the amateur at a glance which tray holds a given solution, and let him use the same trays for the same solutions each time The trays have one, two, three, or four yellow corners

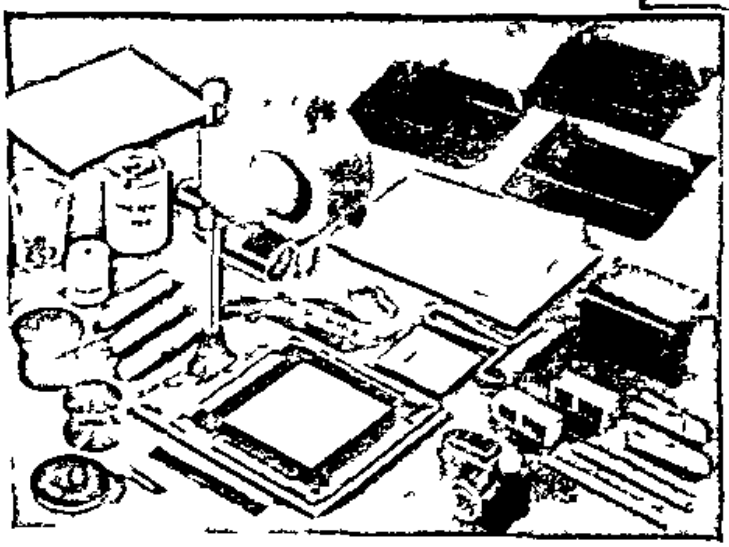


The number of yellow corners on each tray labels it

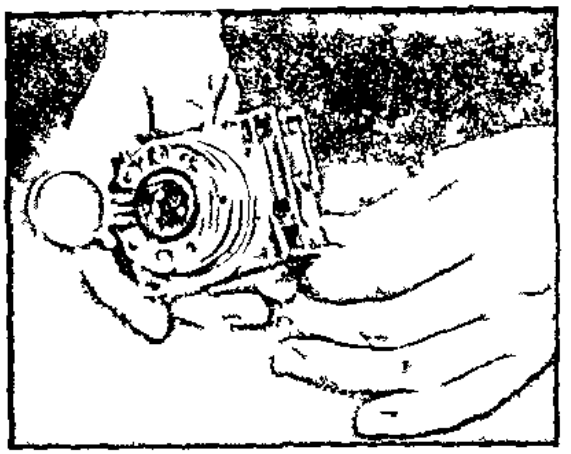
Tyro's Kit Holds Everything from Camera to Enlarger

EVERYTHING from a camera to an enlarger comes in an inexpensive beginner's kit recently marketed. The outfit contains, in addition to a fixed focus camera and a midget enlarger, a reel type developing tank, a darkroom thermometer and stirring rod three plastic developing trays, clips, film, chemicals printing paper, and a darkroom safe light. The kit enables the tyro to cover all phases of photography





Using the enlarger and easel that come with the outfit shown with all its accessories — including a camera — in the photo at the left

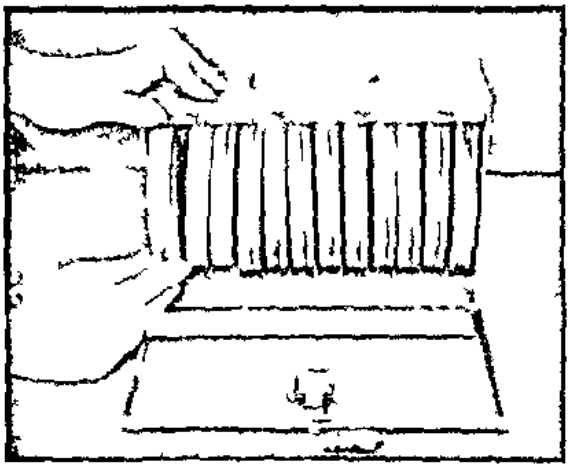


Many Built-In Accessories Feature Midget Camera

LITTLE larger than a pack of cigarettes a precision camera built by Swiss watch makers and recently introduced in this country provides a surprising variety of features Four built in filters are selected by a small knob There is a built in exposure meter a built in sunshade a self-timer and devices for taking stroboscopic pictures panoramas and pictures at right angles The camera s midget tripod is no larger than a fountain pen and has a handy vest pocket clip

Lever Ejects Movie Reels from Handy Container

PRESS a lever and out pops the reel of home movie film you desire from a new metal storage cabinet holding a dozen eight or sixteen millimeter reels When the cabinet is opened the side swings down revealing a strip beneath the film cans on which is written the contents of the various reels Pressing the lever above the desired reel ejects the can holding it



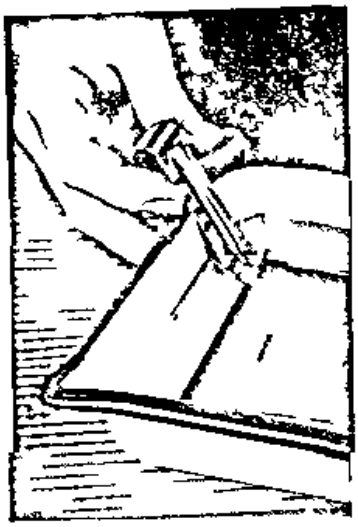
The automat c conta ner holds up to a dozen f lms

Folding Darkroom Is Easily Stored When Not in Use

WEIGHING only forty five pounds a light proof dustproof collapsible darkroom is now available for apartment dwellers and those living in homes where a permanent darkroom is impossible Assembled it provides a working space 7 long 6½′ high and 3½′ wide It can be knocked down in a few moments and when folded forms a compact unit only 46″ by 26½″ by 8½″ The folding darkroom is constructed of special double faced box board.



Ideal for apartment dwellers th s roomy fold ng da kroom requ es l ttle storage space



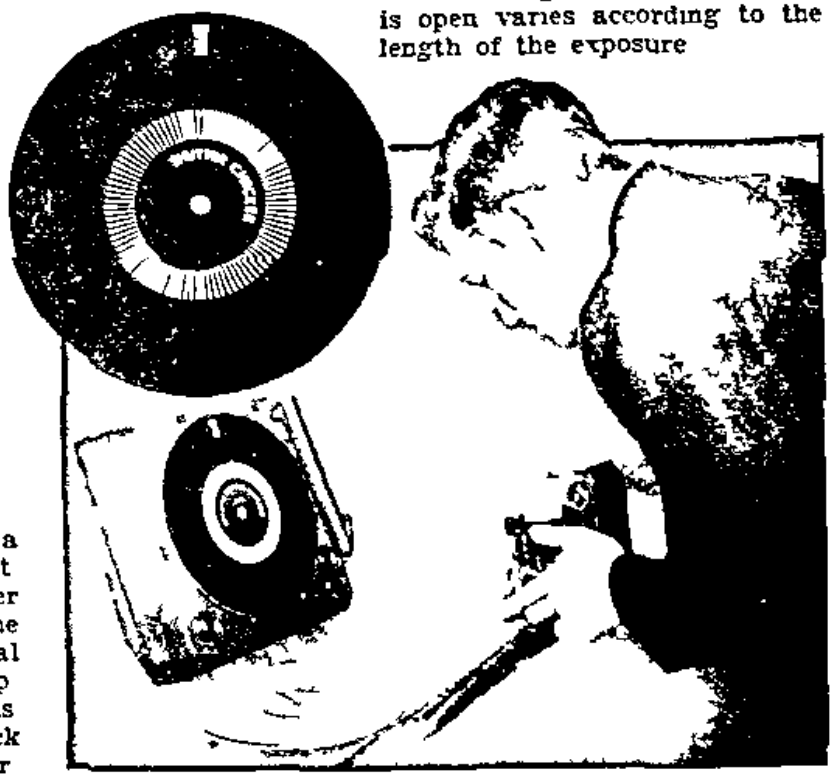
C pped to the edge of a t ay the momete s out of the way

Tiny Thermometer Clipped to Tray

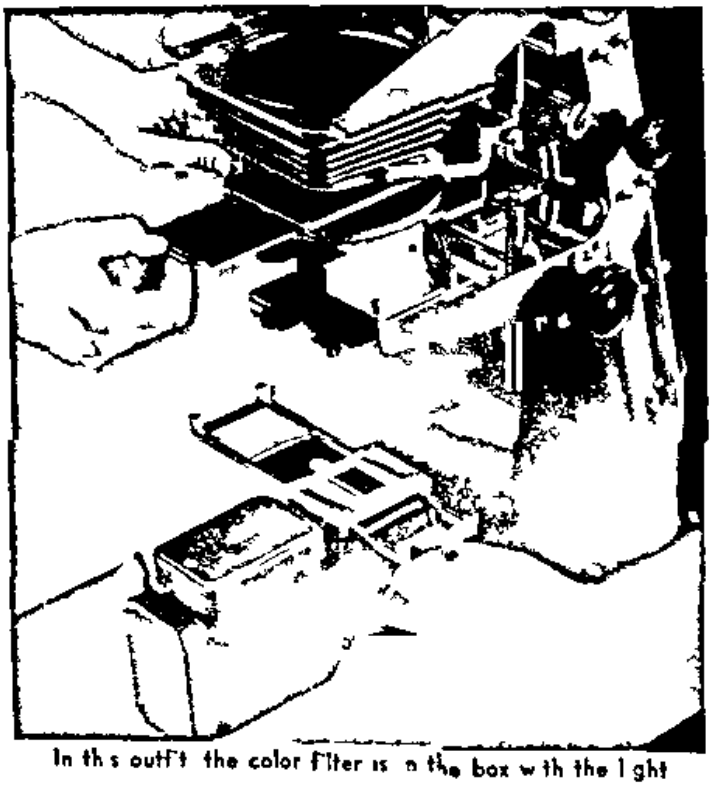
CLIPPING to the edge of a photograph c tray a m dget out of the way thermometer gives a constant check on the temperature of chemical solutions used in the develop ment of negat ves prints *and enlargements* The black expand ng flu d in the ther mometer is said to be easily seen under safelights

Phonograph-Disk Shutter Checker

BY PLACING a specially marked paper disk on a phonograph turntable and photographing it with the turntable revolving the amateur can test the speed of his betw een the-lens shutter The d stance a dot on the circumference of the disk mov es during the time the shutter is open varies according to the length of the exposure



Photog aph ng the revolv ng d sk on a phonograph turntable The developed f lm is projected on the d sk s back to get shutter speed



In th s outf t the color f lter is n the box w th the l ght

Apparatus Simplifies Color Separation

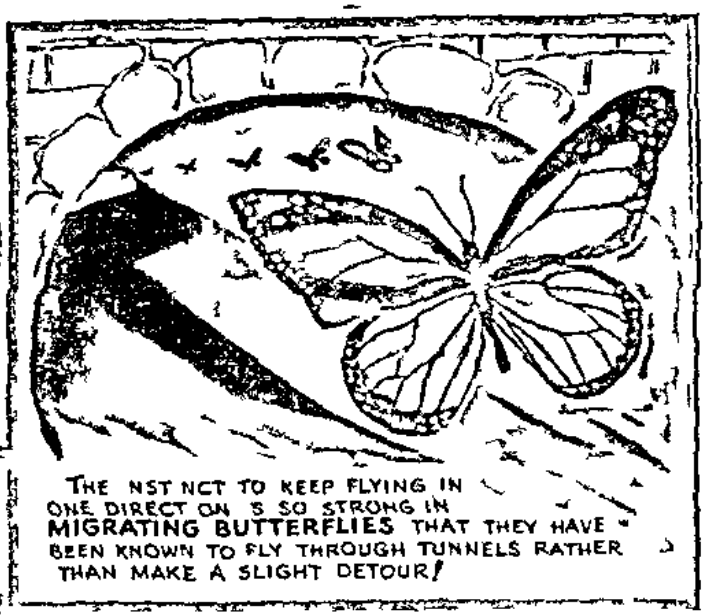
REVERSING the usual procedure for making color separation negatives from color transparen cies a new darkroom appliance is said to produce improved re sults Ord narily the transpar ency is placed in an enlarger and the image projected three times on panchromatic film with a different colored gelatine filter placed betw een the transparency and the film each time The new method employs a special metal box containing a lamp that illumi nates the transparency from be hind with the gelatine filter in serted betw een the light and the transparency A camera holding panchromatic film is focused on the illuminated transparency to record the separation negatives. The new procedure is said to prevent fogging of the film.

Un-Natural History

BY *Gus Mager*



OUR SOUTHERN **TOAD** SWELLS UP LIKE A BALLOON AND REARS H GH ON ITS LEGS WHEN FR GHTENED OR ENRAGED



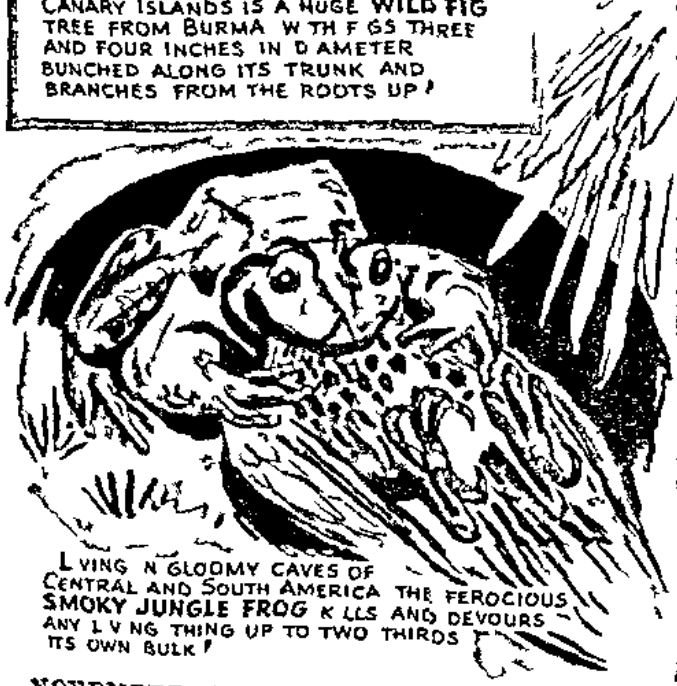
THE NST NCT TO KEEP FLYING IN ONE DIRECT ON S SO STRONG IN **MIGRATING BUTTERFLIES** THAT THEY HAVE BEEN KNOWN TO FLY THROUGH TUNNELS RATHER THAN MAKE A SLIGHT DETOUR!



IN A BOTANICAL GARDEN N THE CANARY ISLANDS IS A HUGE **WILD FIG** TREE FROM BURMA W TH F GS THREE AND FOUR INCHES IN D AMETER BUNCHED ALONG ITS TRUNK AND BRANCHES FROM THE ROOTS UP!



NIGHTHAWKS ALWAYS SIT LENGTHWISE ON A BRANCH NEVER CROSSW SE L KE OTHER B RDS! THE REASON T NY WEAK FEET!



L VING N GLOOMY CAVES OF CENTRAL AND SOUTH AMERICA THE FEROCIOUS **SMOKY JUNGLE FROG** K LLS AND DEVOURS ANY L V NG THING UP TO TWO THIRDS OF ITS OWN BULK!

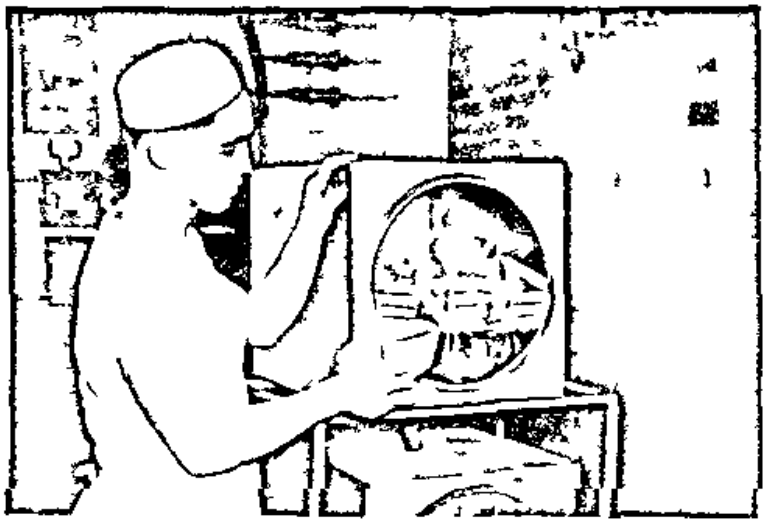
ALTHOUGH SOME **SHARKS** LAY A FEW EGGS N LEATHERN CASES USUALLY THE EGG STAGE IS PASSED WITH N THE PARENT S BODY AND THE YOUNG ARE BORN WELL DEVELOPED!





Applying the new floor finish It dries within twenty four hours

Cheese Flavored by Hickory Smoke



Cheese comes out of the smoke house ' Hickory k ndling is used

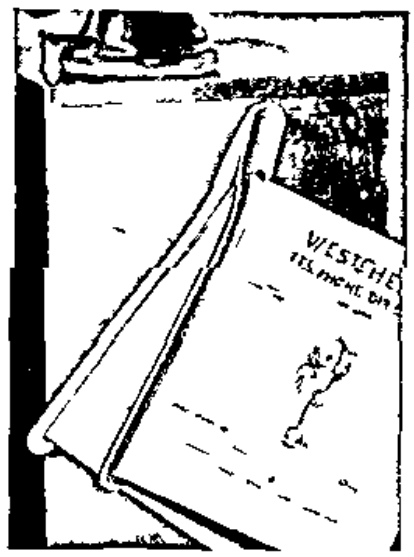
CHEESE, like tasty hams now is being flavored with hickory smoke In the process developed by experimenters at Iowa State College two metal chambers constitute the ' smoke house " In the first, hickory kindling burns to provide the smoke which is piped to a second chamber above it Here it comes in contact with small rectangular pieces of cheese wrapped in parchment The wrapping keeps the cheese clean, while letting the flavor penetrate

"Concrete" Finish for Wooden Floors Put On with Brush

RESEMBLING concrete but applied with a roofing or whitewash brush as illus trated at the left a new paint' prevents old wooden floors from splintering Concrete floors with a tendency to dust may also be treated successfully Because of its extreme durability, the finish is recommended for places subjected to heavy foot traffic, such as steps, and porch flooring Two coats give a glossy enamel surface The finish dries in twenty four hours, and may be obtained in four tints — green, red, brown, and gray

Phone-Book Hangers Keep Table Clear

A CONVENIENT new set of hangers for directories, attached to the side of a home telephone table keeps the top clear for consulting a shopping list or jotting down memoranda Holders made of synthetic plastic, in different colors, distinguish one phone book from another



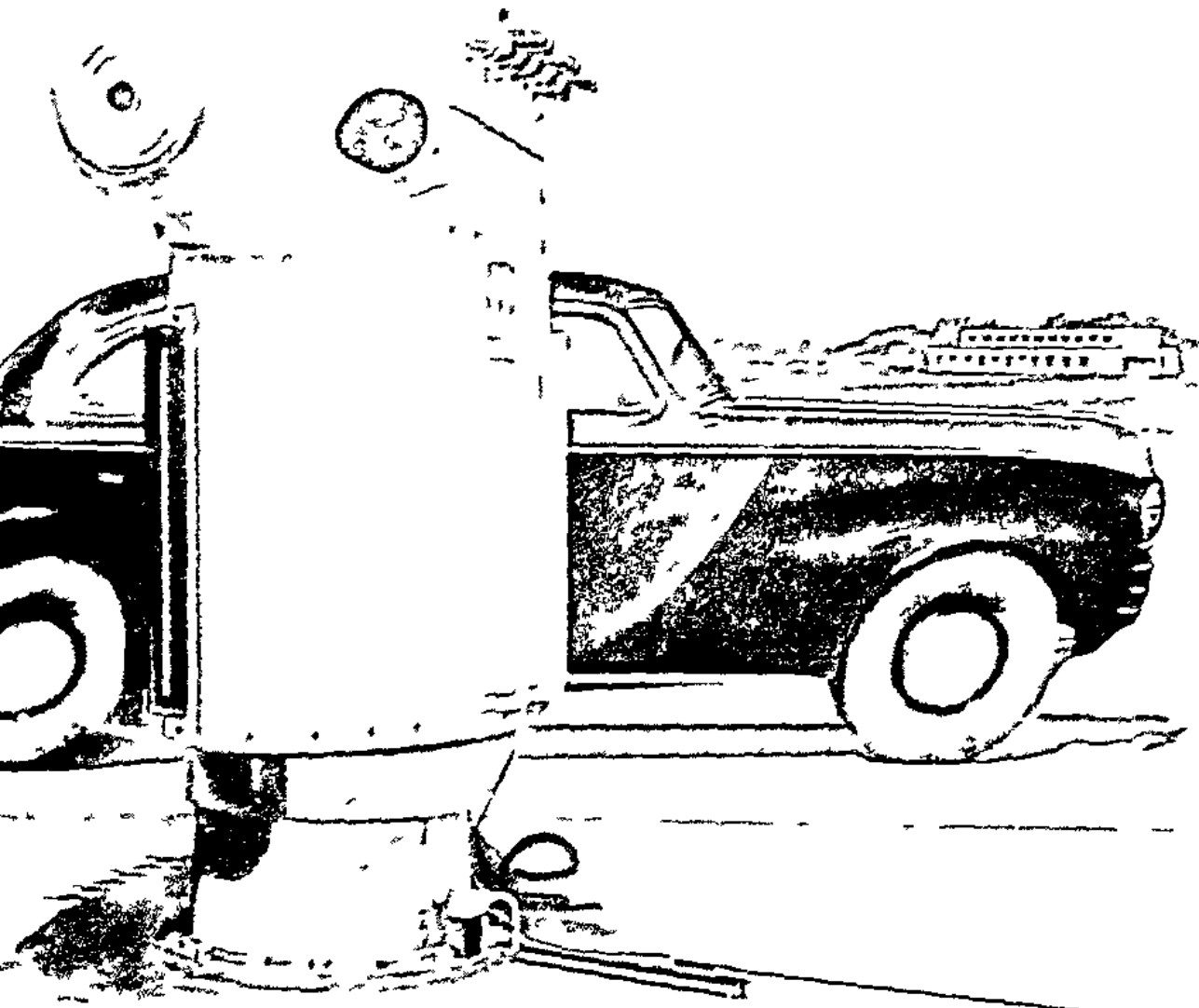
Colored hangers hold directories

AUTOS

Visit the Auto Show with Gus & Joe

HOW YOUR 1941 CAR WAS TESTED

Drivers Wilbur Shaw Won't Ride With

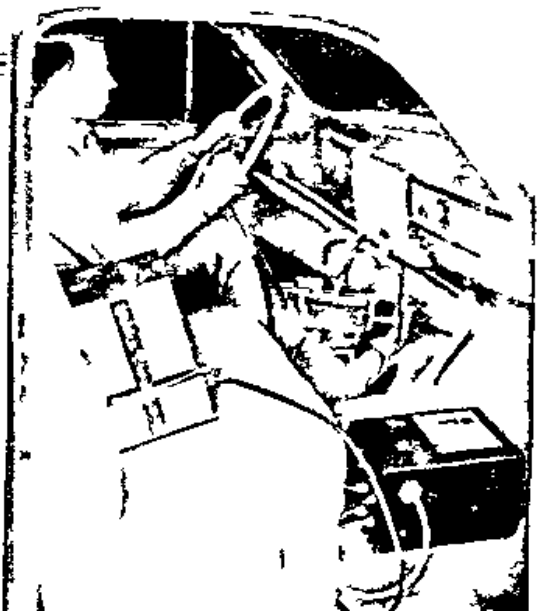


Have you ever felt cross winds tug at your car on a windy day? Auto engineers use this big wind machine to produce the same effect when test ng new models

Testing Your 1941 Car



A new model h ts the bathtub at Gen e al Motors prov ng g ound to show how t can stand a duck ng



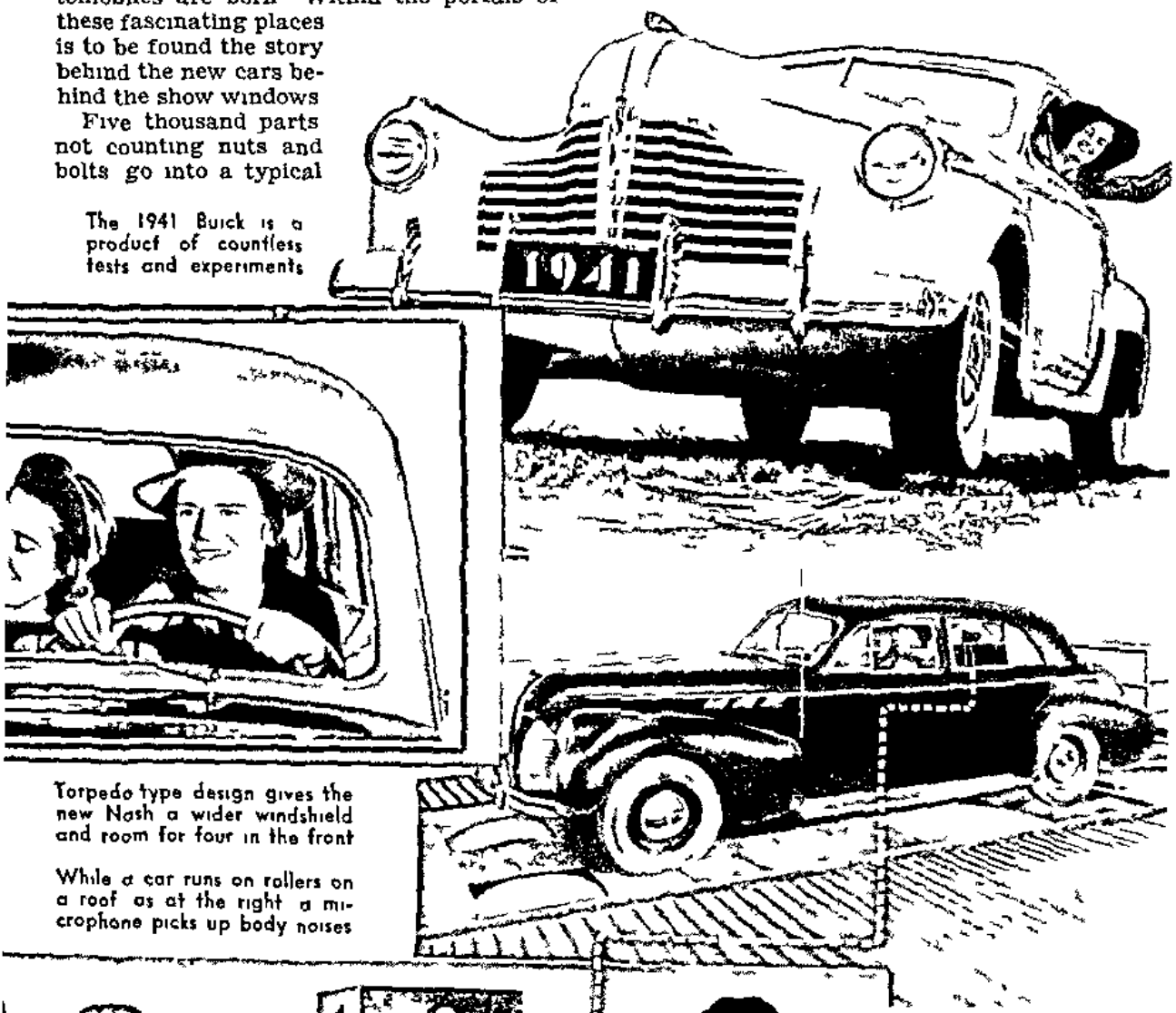
In the Laboratory and on the Proving Ground, the New Models Are Put Through Grueling Trials

How much pedal pressu e does t take to apply brakes at var ous speeds? Trial runs w th th s reco d ng dev ce tell the story

BECAUSE engineers mounted toy size automobiles upside down in a wind tunnel, your 1941 car will give you more mileage to the gallon than your last one It holds the road better when a gust of wind strikes it, for test drivers have sped cars like it past the fifty-mile-an-hour blast of a giant propeller Its greater stamina and resistance to wear are consequences of such bizarre experiments as giving gears an artificial fever in a radio furnace

The fact that the new cars excel the 1940 models isn t any happen-so It s the inevitable result of unceasing research and constant trial at the great engineering laboratories and proving grounds where new automobiles are born Within the portals of these fascinating places is to be found the story behind the new cars behind the show windows

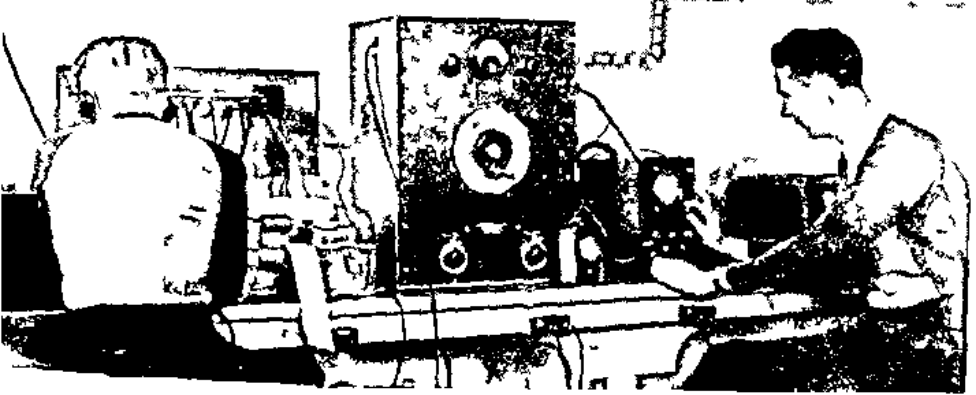
Five thousand parts not counting nuts and bolts go into a typical 1941 car To design them, and select the best materials available, research specialists employ tools that would be the pride of any leading scientific institution A giant spectroscope reveals which of the fifty-two metallic elements are present in an alloy under test, by telltale lines visible in a rainbow of colors, while ultra-violet and infrared photography detect other identifying lines invisible to the human eye Transparent plastic models of auto parts, examined under polarized or "one way light, show just where stresses are concentrated and make it possible to eliminate useless metal elsewhere Employing a cathode-ray tube



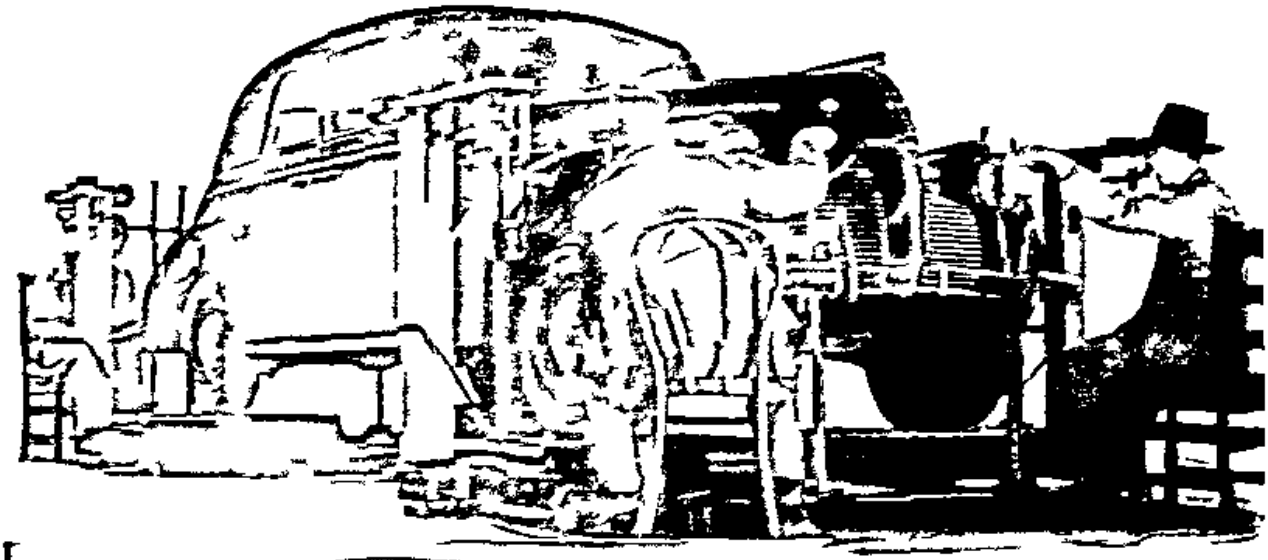
The 1941 Buick is a product of countless tests and experiments

Torpedo type design gives the new Nash a wider windshield and room for four in the front

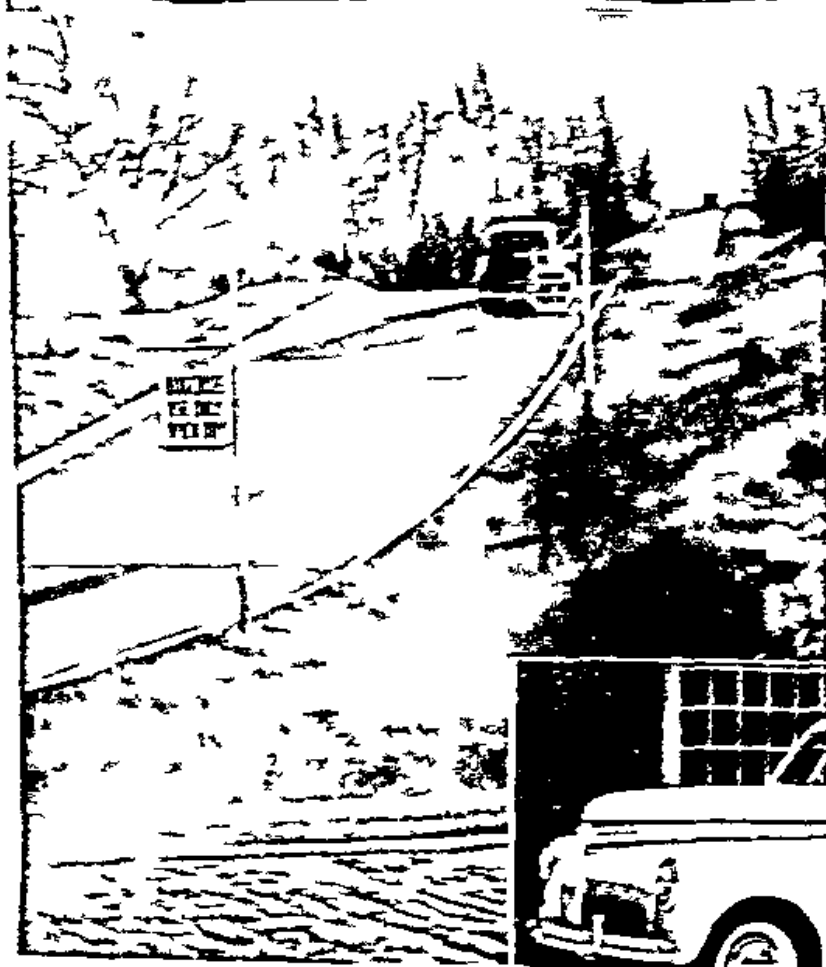
While a car runs on rollers on a roof as at the right a microphone picks up body noises

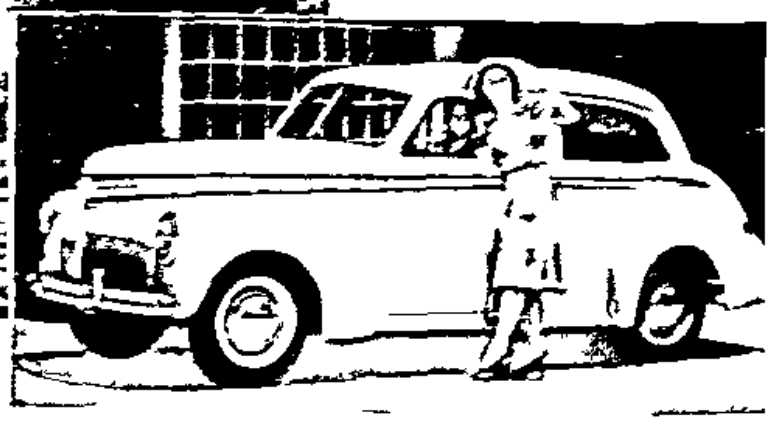


In the laboratory below engineers listen in while an instrument records any sign of a squeak or rattle



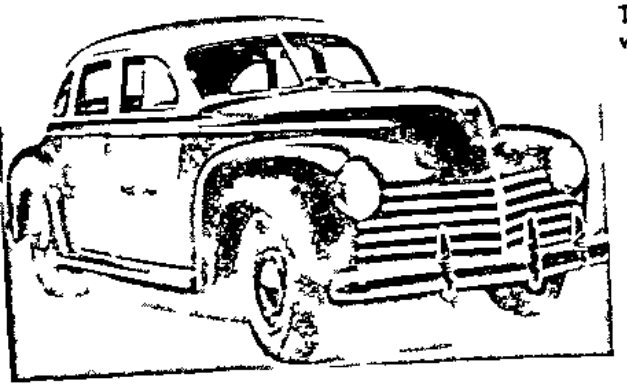


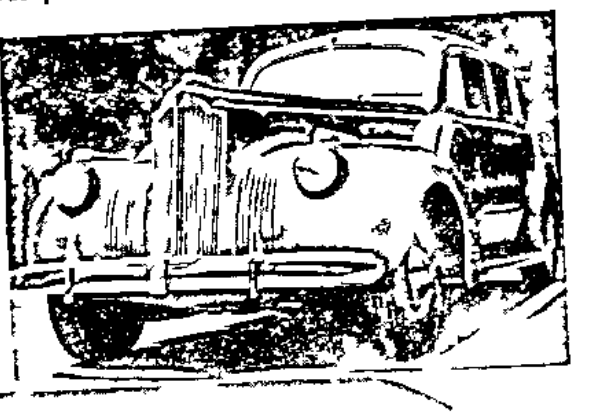




* Roller-coaster hills on the General Motors proving ground try cars under real road conditions

Chrysler s offe ng p ctu ed at the left has the flu d clutch as opt onal equ pment The Packard below embod es sturd ness that was proved in tests l ke that seen n oval

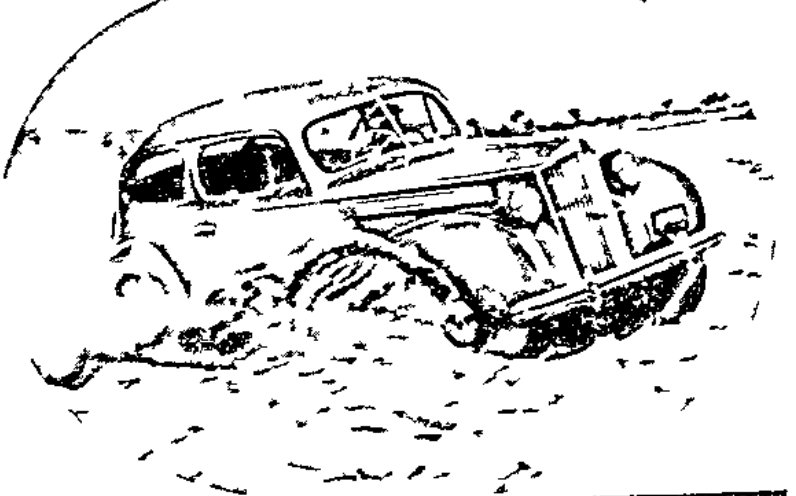


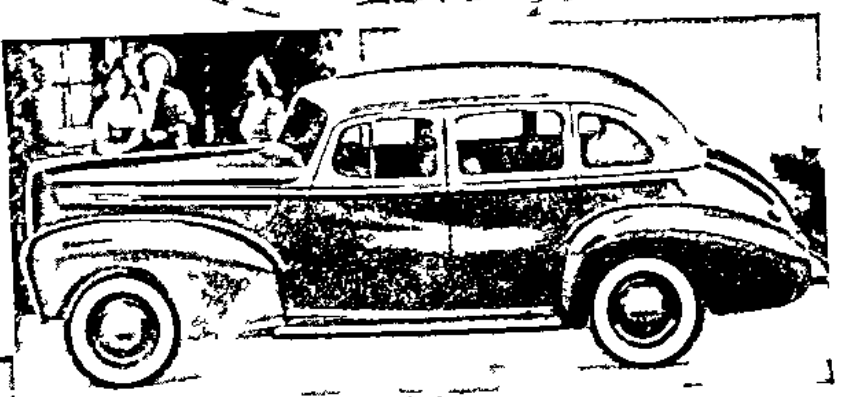


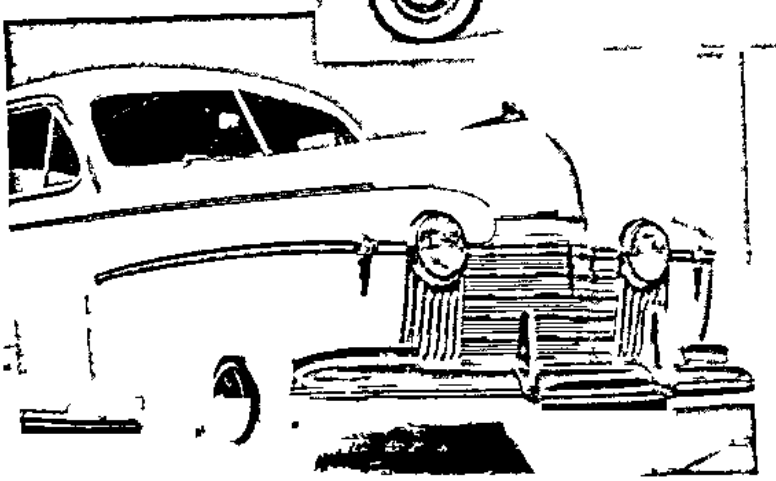
breeze of measured veloc ity sens tive meters and balances record its wind res stance in pounds Only a slight change in the curve of a fender or the slope of a rear deck may markedly affect the en gine power needed for maximum performance

Based on myriads of such tests experimental cars must be built and given a lifetime of wear and tear in a few weeks Thus any possible faults are discovered and cor rected before a new model goes into production Since mistakes are ex pensive both to maker and consumer buyers get the benefit in lower cost and upkeep

Speed lanes hairpin turns test hills and torture roads of jagged blocks try *(Con tinued on page 243)*

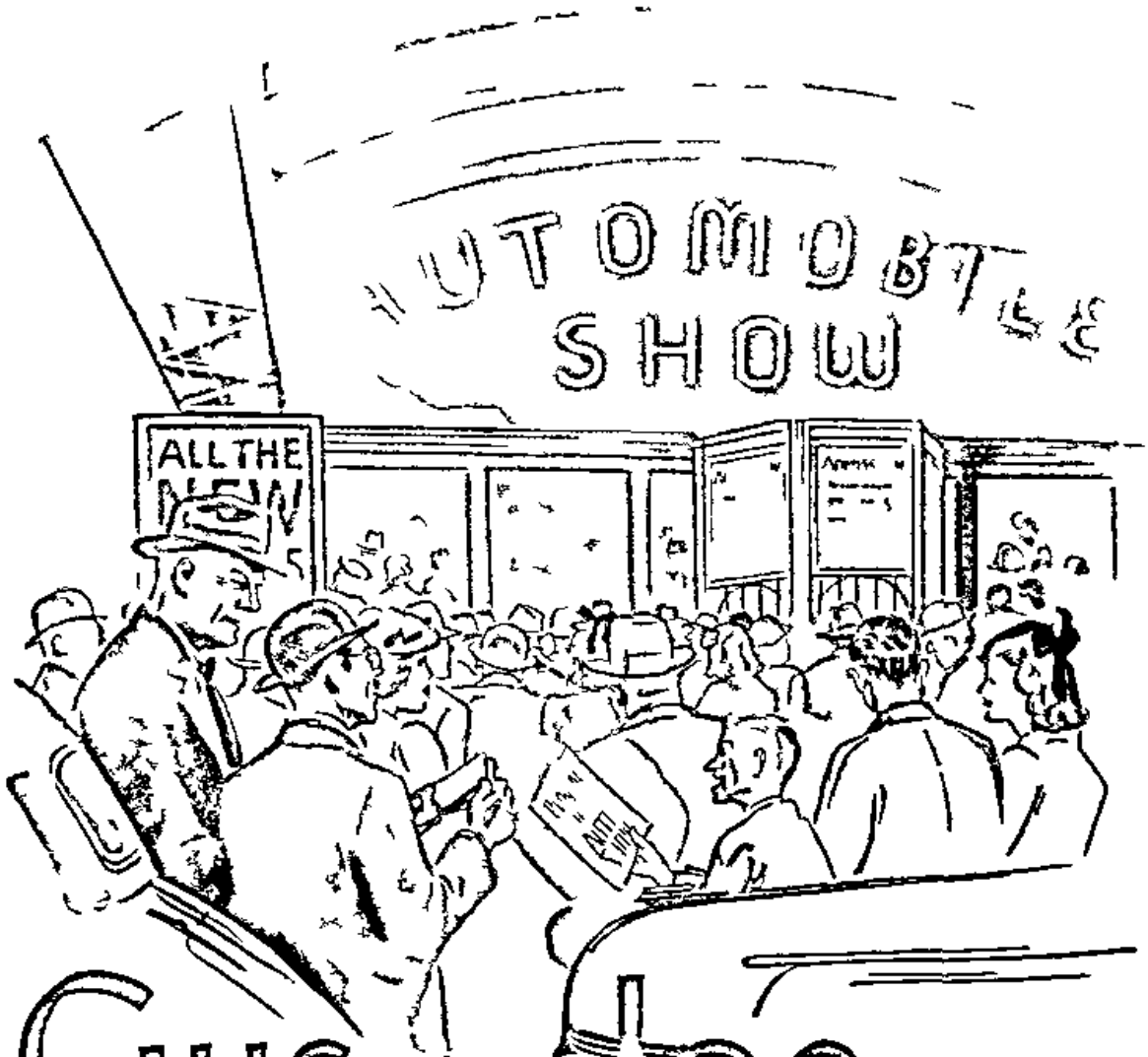






Hudson s symphon c styl ng offers full harmony of color between the body and the nter or tr m— for the f rst t me n a full l ne of standard cars

Runn ng boards of the new Oldsmob le at the left are concealed when the doors are closed Another novel featu e s a s lent mesh transm ss on of latest type



Gus and Joe GO TO THE SHOW

"BY GUM you re all starry eyed Joe Clark sa d to his Model Garage partner Gus Wilson as they started up the broad stairway of Grand Central Palace

Sure I am Gus adm tted without shame This New York Automobile Show always gives me a thrill and I ve been coming to it for a flock of years I remem ber my first show as plainly as if it had been yesterday—and it must have been thirty five years ago They held it in Madison Square Garden in those days—the old Garden Cad llacs and Oldsmobiles and White Steamers and Autocars—those old t mers look funny when they dig them out now but they were hot stuff then But it was an exhibit up in the balcony that inter ested me most—a racing car called the 999 There was a thin faced quiet spoken sort of fellow standing by it in the booth and somehow we got to talking He told me that his name was Henry Ford and that he had built the car and driven it at better than sixty miles an hour on the ice out near De tro t. That *was* a thrill—talking to a fellow who had driven a mile a minute But I got a bigger thrill when I got back on the main floor and a girl came along all dressed up to kill and happened to give me a look out of the darndest green eyes I d ever seen—and that goes for now too It sort of took my breath away and no wonder—I heard a fellow behind me say That was Anna

Let's String Along with the Model Garage Partners As They Help the Millers Shop for a New 1941 Car

By MARTIN BUNN

Held who just passed us Now Joe don t tell me you don t know who Anna Held was

Yes I know who Anna Held was Joe assured him She was long before my time but I saw a movie all about her a few years ago It was one of those historical movies he added unkindly I suppose it was the remembrance of that one look she gave you with her green eyes back around 1905 that kept you from ever getting married

Well I wouldn t go quite that far Gus told him But I was *young* then—

Sure—you were young then Joe parroted And now whenever you get close to a few new style gas buggies you go downright childish. I ll bet a quarter you ll come out of here talking about buying yourself a new car Well *I* won t—mine s good for another two or three years

Gus grinned wisely as he handed over their tickets and they started into the big exhibition hall Let s start by having a look— he began and was interrupted by a feminine voice

Yoo hoo Yoo hoo Oh Mr Wilson

He looked in the direction of the hail and saw the talkative Mrs Miller and her husband Henry

Oh my gosh Gus muttered Why did it have to be *her*?

We ll have to talk to them Joe urged We ve got to be polite—they re darned good customers

Mrs Miller didn t wait for them to make a move She skipped over to them talking as she came

Oh this is just wonderful she babbled You re the people I most wanted to see here I ve been coaxing Henry to buy us a new car and at last he has recapitulated—capitulated I mean Now you and Mr Clark can help us pick out the one we should get

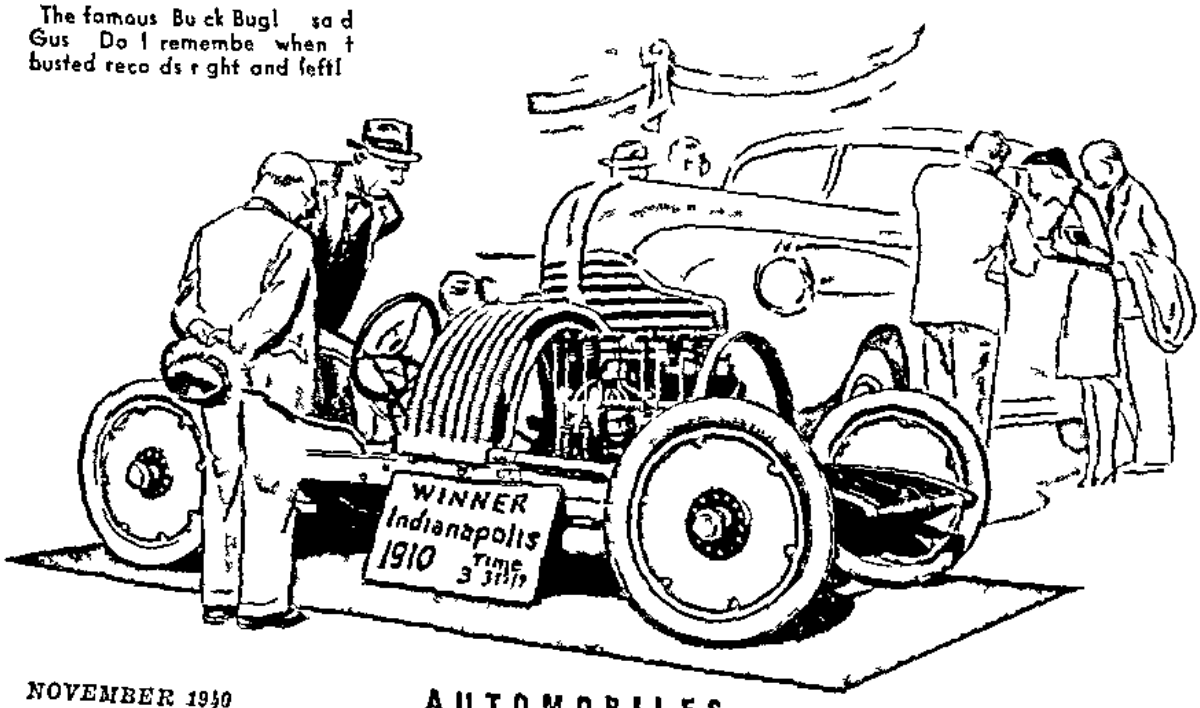
I said maybe her husband hedged glumly

Maybe always means yes Mrs Miller said archly I m sure it would save us money in the long run

What sort of car are you people thinking of getting? Gus put in to forestall an argument

I just saw one I d *love* to have Mrs Miller said Henry hasn t seen it yet. Come on—let s all go and look at it

She led the way down an aisle lined with sleek 1941 cars and Gus s quick and experienced eye noted that nearly all of them looked longer wider and lower than the 1940 models that many of them were more definitely streamline that two tone finishes were frequent and that bumpers were more massive than any he d seen before But just as he was about to become vocal about some of his observations Mrs Miller



The famous Buick Bugle said Gus Do I remember when it busted records right and left!



That Gus told Henry Miller is the principle of the fluid clutch

brought up in front of a Super Eight Custom 180 Packard and announced brightly This is the one"

Gus looked at the big beauty Then he looked at Henry and grinned "That's quite a lot of automobile, Mrs Miller," he said It looks longer than last year's model,' he added to the salesman.

'The wheelbases of all our models are the same as they were last year," the salesman told him, 'but the over all lengths have been increased by five or six inches, and the hoods are two and a half inches longer"

'What I especially like about this particular car' Mrs. Miller announced importantly, are the really wonderful improvements you can have on it. This gentleman told me about some of them—mechanical refrigeration and air conditioning, for example Just think, on the warmest day—"

'That's a wonderful stunt," Gus agreed, but it's fairly expensive, isn't it?"

The salesman pressed a button on one of the doors and the open window above it closed smoothly He pressed another button and a glass partition slid noiselessly into place between the driver's and passengers' compartments 'Power operated," he announced proudly

"THAT'S a new one on me," Gus admitted. "Where's the gadget that runs it—under the front seat?' He examined the unit interestedly and nodded. 'I see—a reversible electric motor hooked up to a hydraulic pump with a reservoir tank, and a hydraulic cylinder for each window Mighty clever'

The salesman realized that he was talking to a man who knew his automobiles We have a number of improvements this year which I seldom mention to the ladies (so few of them are interested in such things," he said. "New connecting-rod bearings And a new pressure cooling system. It operates at four and a half pounds above the atmospheric pressure on the low-price '110 and the '120 models, and at seven and a half pounds above on the Super models, and raises the boiling point of the cooling liquid so as to permit warmer engine temperatures at all altitudes'

That's interesting,' Gus said. 'I'd like—"

But the conversation had become too technical for Mrs Miller "I think we'd better look all around before we decide on anything,' she told the salesman 'Thank you *so* much"

Some one," Mr Miller said "was telling me about a car—I don't remember which make he said it was—that hasn't got any gears to shift. That doesn't seem possible to me, but if there were such a car it might be a good one for my wife to drive She's always getting stalled shifting gears, and you know how she chips transmission teeth''

"YOU'RE thinking about cars which have what they call the liquid clutch" Gus said. 'There are several of them. There's the Oldsmobile exhibit over there Let's have a look at their Hydra Matic Drive—it's mighty interesting But, say—we've lost your wife and Joe"

'Oh, they'll be all right—we'll run into them somewhere," Henry said with more than a touch of relief in his tone "I want to take a look at this new stunt you're talking about."

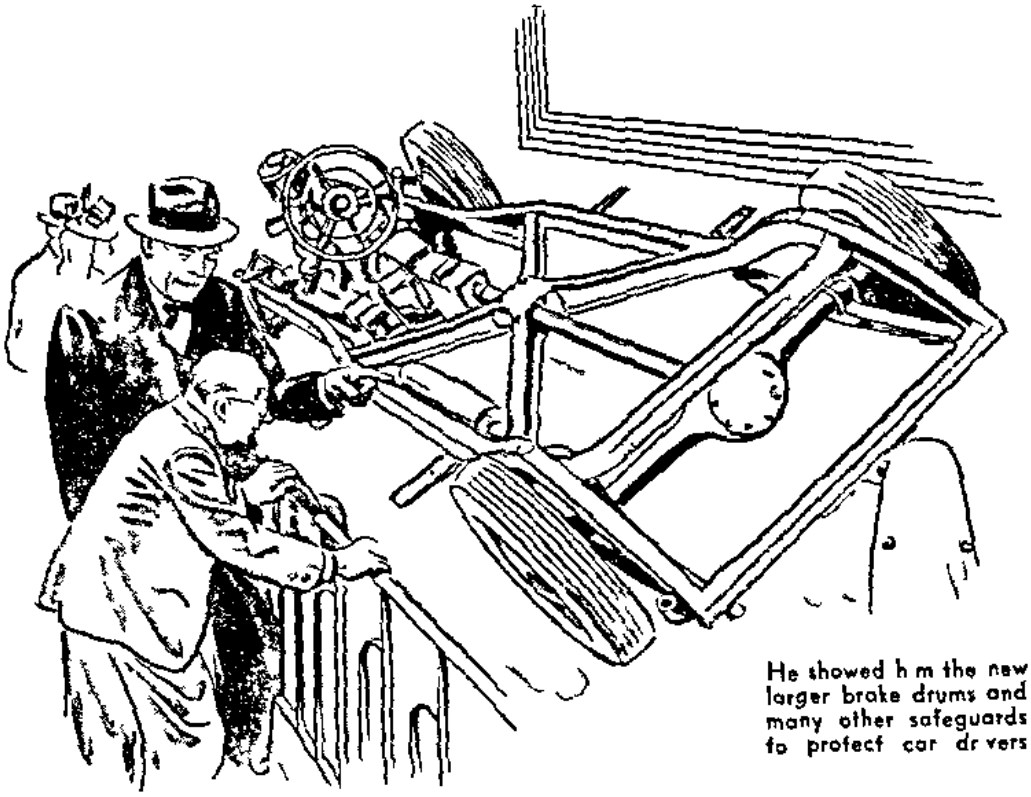
"It isn't altogether new," Gus explained. 'The Oldsmobile people are continuing it from last year, as optional extra-cost equipment. Know how it works?"

'Nope," Henry admitted "I guess I'm still just a Sunday driver who doesn't know a thing about cars"

'Well," Gus said, "you sell electric fans in your hardware store, so you know something about them Now, suppose you hooked one fan up to a wall plug, placed another fan not hooked up, facing it and about an inch away, and then switched on the fan you had hooked up What would the other fan do—the free one?'

"It would turn, too"

'Right!' Gus said. "In other words, the power would be transmitted from the driven fan to the free fan through the air Well, that's the principle of the fluid clutch But it's worked out in the form of a liquid coupling in which oil takes the place of air Two rotors are placed in a case filled with oil One of them is driven by the engine It transmits the power through the oil to the other rotor, which drives the car's



He showed h m the new larger brake drums and many other safeguards to protect car dr vers

wheels In the Hydra Matic drive the liquid coupling is used in connection with an automatic transmission assembly There s no clutch pedal and no gearshift Instead there s an automatic control just below the steering wheel It has four positions—neu tral for parking high for normal driving low for steep hills and heavy going and reverse for backing After you flip the lever into high you don t have to move it for normal driving—you step on the gas pedal when you want to go and step on the brake pedal when you want to stop

Well here are the Oldsmobiles—three sixes and three eights varying in size and price but all mighty pert and modern look ing Built in running boards which are ex posed only when the doors are opened Sealed beam headlamps—they make night driving safer One piece hood—when you lift it you can get at any place in the engine compartment without being a contortionist And Hydra Matic Drive if you want to pay extra for it. Lots of interesting features

Henry Miller shook his head in admira tion You re a wonder Gus he said You just take one look at these new cars and you know all about them

I ll let you in on something Gus con fided This is my *second* trip to the show today I came down to town early and when I met Joe for dinner I told him I d gone to a movie to kill time after I d fin ished my errands Don t let on to him, or he ll never stop kidding me about it—he thinks I m a nut on cars and I guess he s right' That reminds me there s one I missed this afternoon that I want especially to see—that new Nash 600 they brought out to compete with Chevrolet Ford Plym outh and Studebaker in the low price field. I met an old friend of mine who s a big shot with the Nash people now and he told me that they d spent three years de veloping and road testing it and seven million dollars getting it into production Let s go and have a look at it

'HERE S their exhibit Gus said a *min*ute or so later And there s the new 600—it s a classy looking bus isn t it with its torpedo type body and two tone finish It s a good size car too—194 inches over all George told me with full three passenger seats He said that it s built like a bridge—that the body and frame are a single welded unit light, but *twist and rattleproof* Another new feature is the *spring sus* pension—coil springs on all four wheels in tubes and integral with the shock ab sorbers—it s a European idea The car has a six cylinder engine with the manifolds sealed into the block and they claim that an average good driver can get between

twenty five and thirty miles out of a gallon of gas Those other Nash cars are the Aeropowered Ambassador Six and the Aero powered Ambassador Eight They re in the low medium and upper medium price groups and they both have twin ignition valve in head engines—they claim it s the nearest thing to an airplane power plant that you can get in an automobile

You say this Nash 600 was brought out to compete with some other cars Well let s go and look at those other cars Henry suggested

Gus grinned at him You re getting the show bug he said All right—I m with you as long as my dogs hold out Here s the Studebaker exhib it Their Champion is in the low price group They ve upped the horsepower of its six cylinder L-head engine to eighty by making some changes in the cylinder head and the spark plugs The car s longer and wider than last year s model but by cutting down dead weight they ve kept it under 2 500 pounds Notice that there aren t any running boards? Those larger cars are the Commodore and President lines You can get the new slipstream Land Cruiser model in either Well we d better be getting along Henry There s a lot more to see in this show

They got along Gus halted shortly to talk with one of the Plymouth salesmen

How d Plymouth step its motor up to eighty seven horsepower? he queried

New camshaft lifters was the prompt reply They raise the intake valves quicker and farther letting more gas and air enter the cylinders with a rush There s a new intake manifold too that distributes the vapor better to all cylinders They ve added new bearings with five times the life of the old ones And that s not all That added power is multiplied still further with new rear axle ratios that give better getaway and pick up And a higher gear ratio in second speed lets you use it for most of your starting without bothering with low unless you get in a snowdrift or mud If customers want it they can have a Power matic gearshift that uses vacuum to do most of the work In addition there s a new oil cleaner and air filter

Hey Gus Henry managed to get in. Our time s getting short

Thanking the salesman, they moved on to Chevrolet and Ford admiring each in turn Both featured a host of new mechani cal accessory and design improvements besides carrying over from last year such advanced ideas as steering column gear shift and sealed beam headlights with Chevrolet again featuring the vacuum power shift and larger Tiptoe Matic clutch. Ford Mercury Lincoln Zephyr and Lin coln—all newcomers to the Auto Show this year—were gone over from bumper to bumper by Gus s ap praising and approv ing eye

GUS SAYS·

Each year I wonder how the new cars can be any better than last year and each year at th s t me I find out! They just keep on coming up w th more safety power economy com fort and looks! Gosh! I m beg n n ng to talk l ke the car ads myself!

Moving on they ex amined the smart tor pedo bodied Pontiacs Henry was enthusias tic over their big comfortable bodies, and Gus over their precipitation type oil cleaners and new de sign safety steering wheels

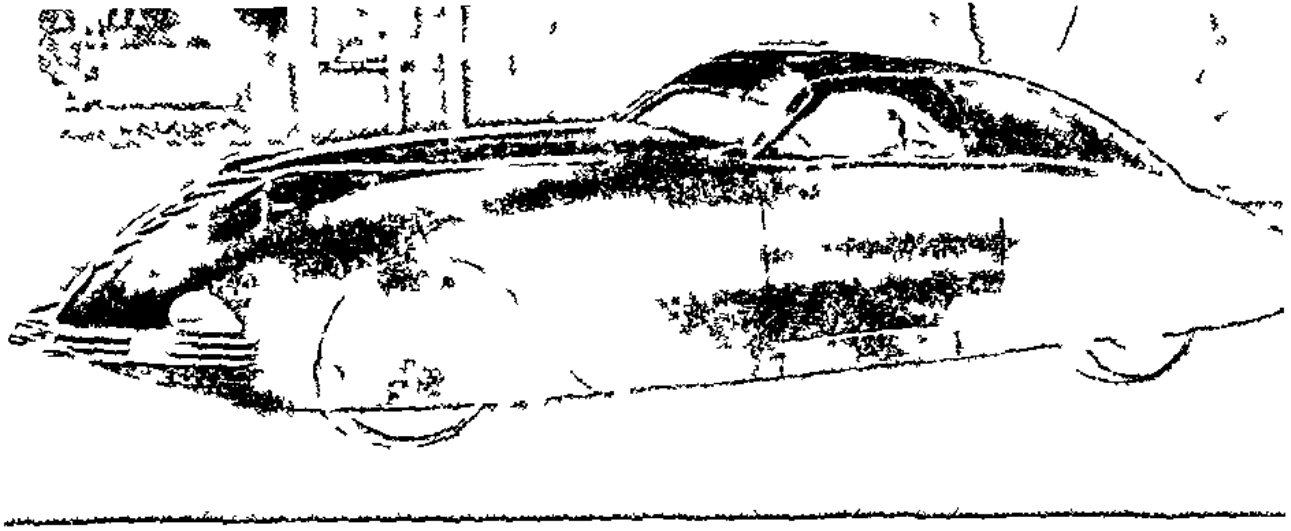
They looked at the Grahams — especially at the new Hollywood Custom model a long racy looking car with a body wider than it is high and its floor only twelve inches from the pavement

Then they looked at the Chryslers—longer wider and lower than the 1940 models They all have fluid drive—it s standard equipment on all eights and on one Windsor model It s optional on the other Windsors and the Royal Gus said It s the same fundamental idea as the Hydra Matic Drive but it s worked out differently Chryslers have conventional transmission assemblies and clutch pedals but under average driving conditions you can shift into high at the start of a long trip and stay there the rest of the way On these 41 cars they ve combined flu d drive with automatic safety control which suits the gear ratio to every normal driving condition keeps the car under positive control and auto matically protects the driver on hills in traffic and on snowy or slippery roads

That fluid drive idea sounds like a mighty good thing to me Henry said Did you say that some other cars have it?

Yes Gus told him as they approached the DeSotos To name a couple more DeSoto and Dodge And on DeSoto it comes with a new transmission But DeSoto is also available if you wish with a regular trans mission to w h ch a vacuum type gearshift booster can be added

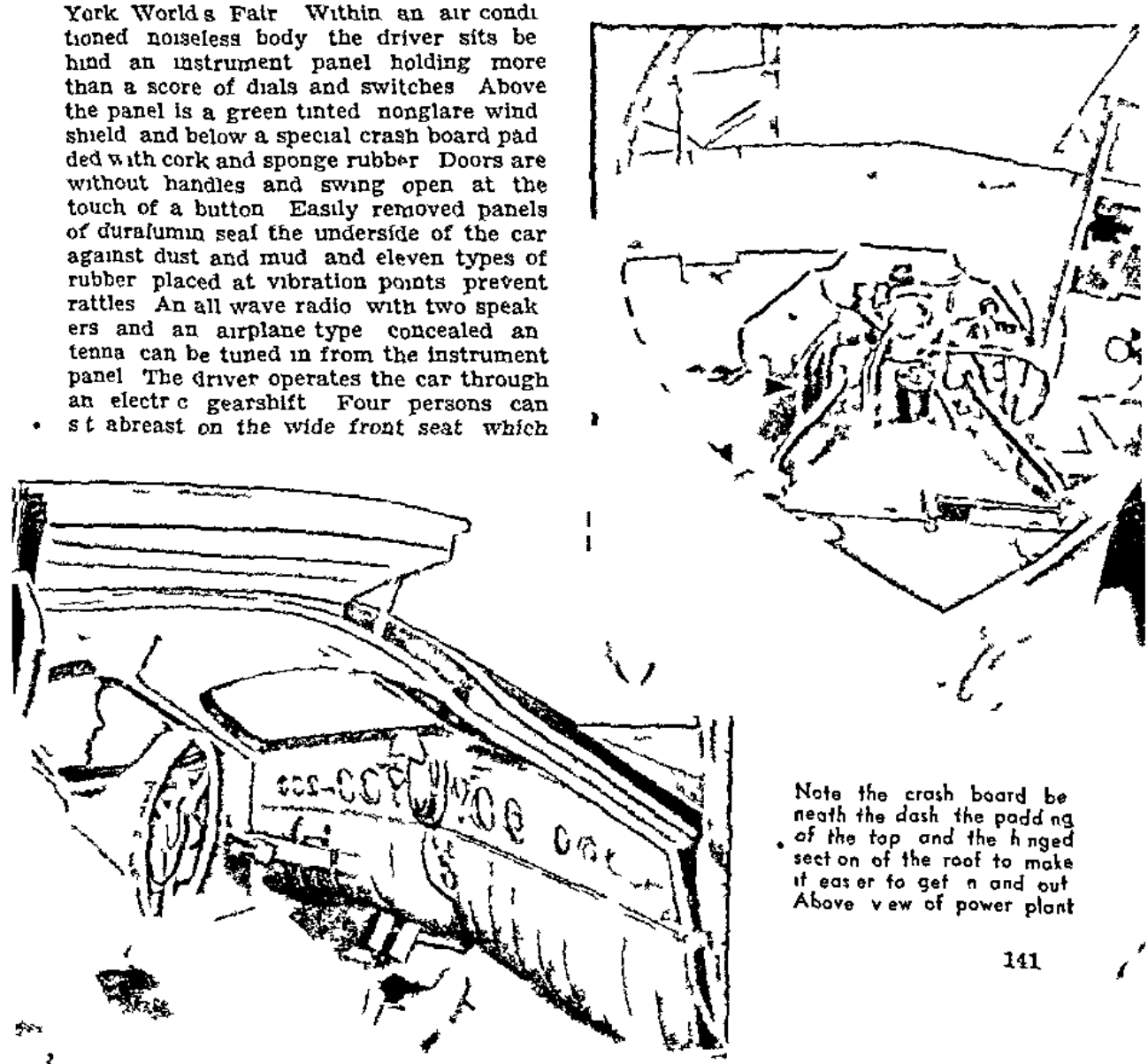
Those new safety rims on most of the Chrysler line keep you from throwing a tire when you *(Continued on page 241)*



W th an a rplane type motor and front wheel dr ve th s fully st eaml ne car makes 115 m les an hour

Is This the Motor Car of Tomorrow?

REPLETE with striking innovations a motor car of tomorrow that is ready to roll on the highways of today is part of the Electric Utilities exhibit at the New York World s Fair Within an air condi tioned noiseless body the driver sits be hind an instrument panel holding more than a score of dials and switches Above the panel is a green tinted nonglare wind shield and below a special crash board pad ded w ith cork and sponge rubber Doors are without handles and swing open at the touch of a button Easily removed panels of duralumin seal the underside of the car against dust and mud and eleven types of rubber placed at vibration points prevent rattles An all wave radio with two speak ers and an airplane type concealed an tenna can be tuned in from the instrument panel The driver operates the car through an electr c gearshift Four persons can s t abreast on the wide front seat which is formed of molded rubber to eliminate vibration and road shock Powered by an airplane type engine this car of the future can reach a peak speed of 115 miles an hour



Note the crash board be neath the dash the padd ng of the top and the h nged sect on of the roof to make it eas er to get n and out Above v ew of power plant



These v ews show the gla ep oof rear-v ew m rro befo e and after ad ustment to "d m" the headl ghts of a co follow ng just beh nd

Mirror Kills Glare of the Car Behind for Night Driving

INSTANTLY convertible for day or night driving a new rear view mirror cleverly turns a familiar optical defect into an advantage Look slantwise into an ordinary m rror and you see double. The silvered backing reflects ninety per cent of the l ght, giving a strong image and the outer surface of the glass reflects ten percent, giving a weak or "ghost" image By using glass of wedge-shaped instead of flat cross section, the new car mirror separates these two images. In the daytime it is turned so that the strong reflection from the silver back ing shows the road behind. At night, tilting it slightly upward eliminates the bother some glare of following head lights, which, however remain plainly visible by their dimmed "ghost reflection from the glass surface. Dotted lines in the accompanying photographs represent the reflection from the silvered part of the mirror

Flash Light for Mechanics Can Shine Around Corners





P ped-l ght" flash n use At the r ght t is f tted w th a magnet to p ck up parts

"PIPING" light around corners through plastic rods first applied in surgery now finds wide industrial use in a special flash light fo" auto mechanics and radio men. Interchange able rods of various shapes direct illumination to hard to-get at places. One type with a powerful little magnet em bedded in its tip can lift parts weighing up to three quarters of an ounce. Standard cells power the light.

Car-Battery Charger Does the Job While You Wait

RECHARGING your car's battery while you wait, a new portable unit takes an average time of only twenty-seven minutes according to the maker Thus the operation may be performed simultaneously with other servicing A special motor-generator set—the secret of the speed-up method—automatically varies the charging rate to maintain the maximum input that the battery's changing voltage and internal resistance will safely allow Electric dials permit a preliminary sixty second check-up on the battery which need not be removed from the car either for testing or charging

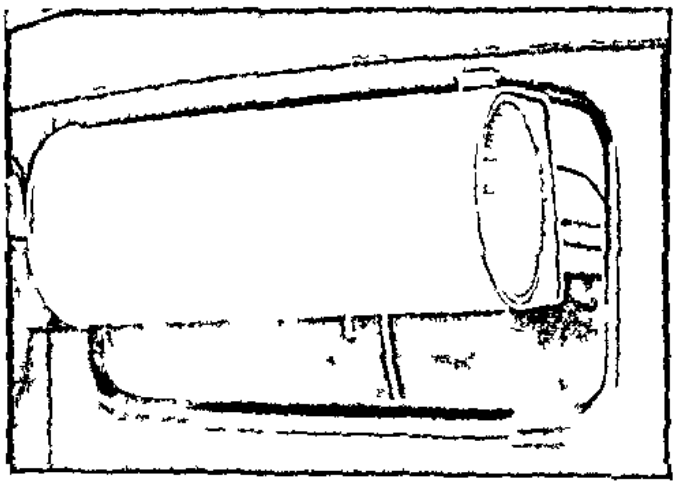


This unit will charge the battery while you are having your car greased

Night-Driving Glasses
Use Wire-Mesh Lenses

BLINDERS of wire mesh in new spectacles designed for night driving are said to shield the eyes from the glaring headlights of oncoming cars Mounted in an eyeglass frame the screening absorbs enough light to prevent retinal fatigue, without interfering with safe vision

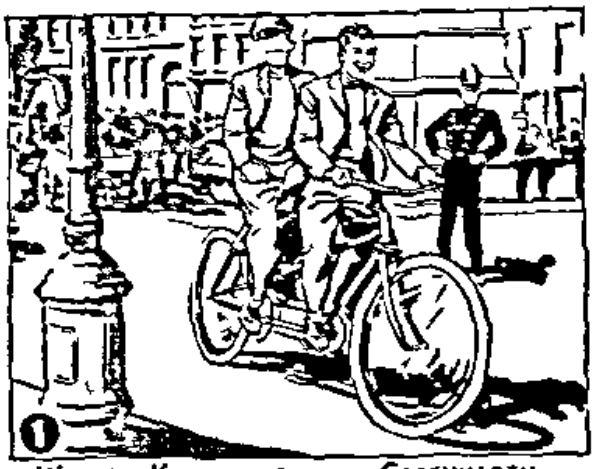

Wire screening in place of glass lenses cuts down the light that reaches the eyes



Quickly Installed Air Cooler for Warm-Weather Driving

INSTALLED or removed in a few minutes, the new air cooler shown above fits any make of car Filtering and purifying the air besides lowering its temperature by evaporating a supply of water, the device operates automatically while the car is in motion A pair of enterprising operators discovered a way to make a tidy summer profit with a supply of the conditioners One rented them to west-bound tourists at the Needles, Calif, gate of the Mohave Desert, while his partner collected and re-rented them to east-bound motorists at San Bernardino

Here's My Story



1

William Knudsen, born in Copenhagen, Denmark, in 1879, was christened Signius Wilhelm Poul Knudsen. As a boy he worked in a bicycle shop and helped build a tandem, the first seen in the Danish capital



2

Just before his 21st birthday, Knudsen came to the U.S. As he was walking down the gangplank, an official shouted, "Hurry up," and Knudsen has been hurrying ever since



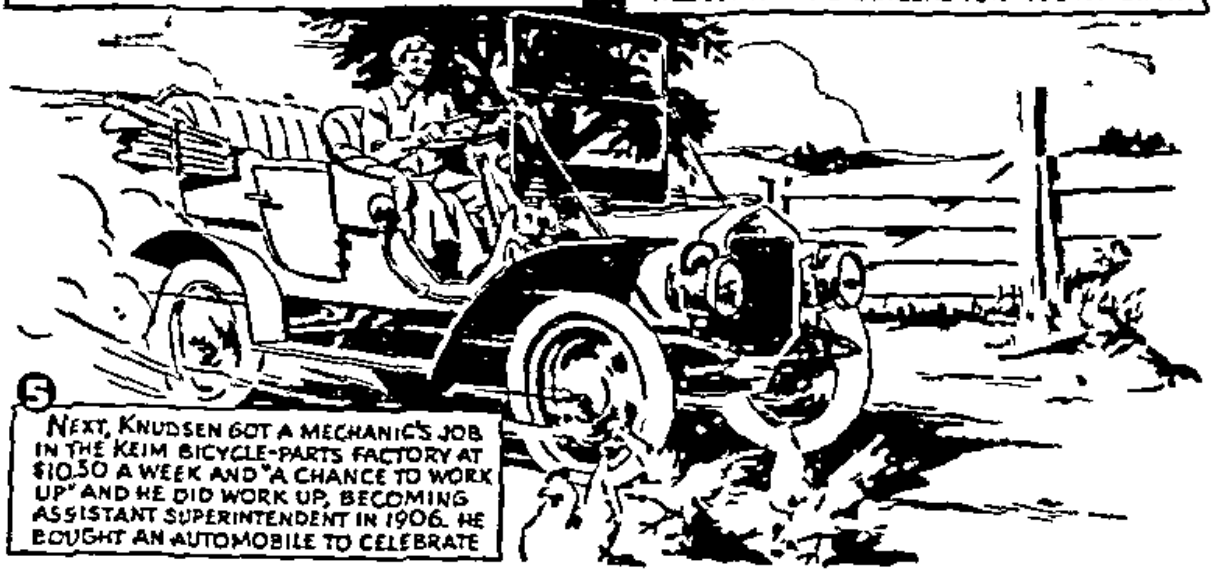
3

His first job in America was at the Seabury Shipyard in Morris Heights, N.J. as a reamer on torpedo boats. He earned $1.75 a day



4

When winter came the shipyard closed down, but Knudsen found another job in the Salamanca, N.Y., roundhouse of the Erie Railroad. He worked seven nights a week repairing boilers for $100 a month



5

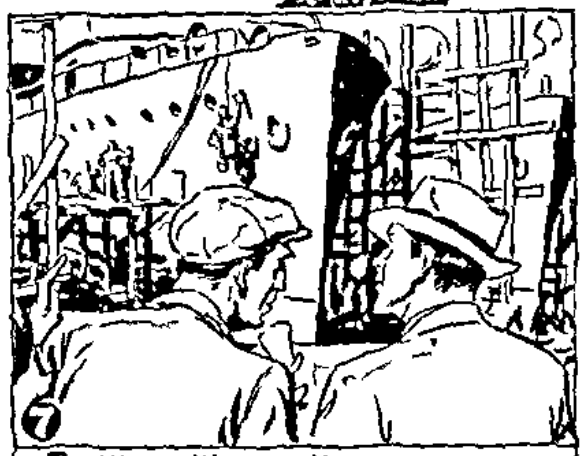
Next, Knudsen got a mechanic's job in the Keim bicycle-parts factory at $10.50 a week and "a chance to work up" and he did work up, becoming assistant superintendent in 1906. He bought an automobile to celebrate

THE CAREER OF WILLIAM KNUDSEN

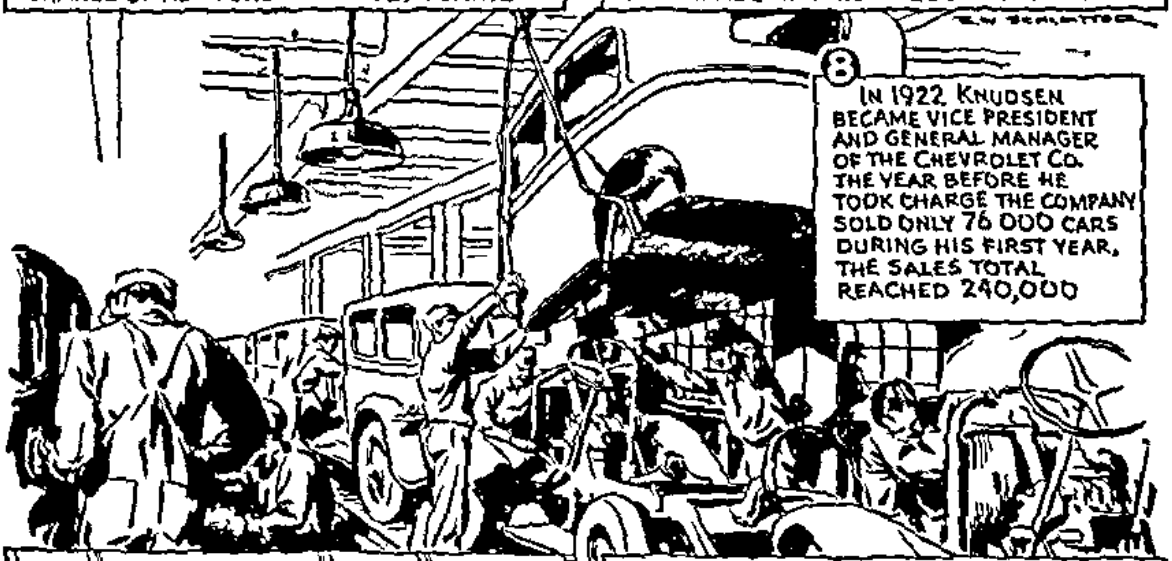




WITH AUTOMOBILES GAINING POPULARITY, THE BICYCLE FACTORY TURNED TO MAKING AUTO PARTS IN 1911, HENRY FORD BOUGHT OUT KEIM AND SOON KNUDSEN WAS IN CHARGE OF ALL FORD ASSEMBLY PLANTS



THE WORLD WAR PUT KNUDSEN BACK IN SHIPBUILDING HE WAS GIVEN THE JOB OF TURNING OUT FORDS SUBMARINE CHASERS FOR THE GOVERNMENT WHEN THE WAR ENDED, FORD MADE HIM HIS PRODUCTION MANAGER



IN 1922 KNUDSEN BECAME VICE PRESIDENT AND GENERAL MANAGER OF THE CHEVROLET CO. THE YEAR BEFORE HE TOOK CHARGE THE COMPANY SOLD ONLY 76 000 CARS DURING HIS FIRST YEAR, THE SALES TOTAL REACHED 240,000



TWO YEARS LATER KNUDSEN WAS ELECTED CHEVROLET'S PRESIDENT IN 1933 HE WAS MADE EXECUTIVE VICE PRESIDENT OF GENERAL MOTORS AND IN 1937 BECAME PRESIDENT



LAST SPRING THE IMMIGRANT WHO HAD ARRIVED AT ELLIS ISLAND FORTY YEARS BEFORE WAS SUMMONED BY PRESIDENT ROOSEVELT AND GIVEN HIS GREATEST JOB— THE SUPERVISION OF AMERICA'S VAST INDUSTRIAL DEFENSE PROGRAM

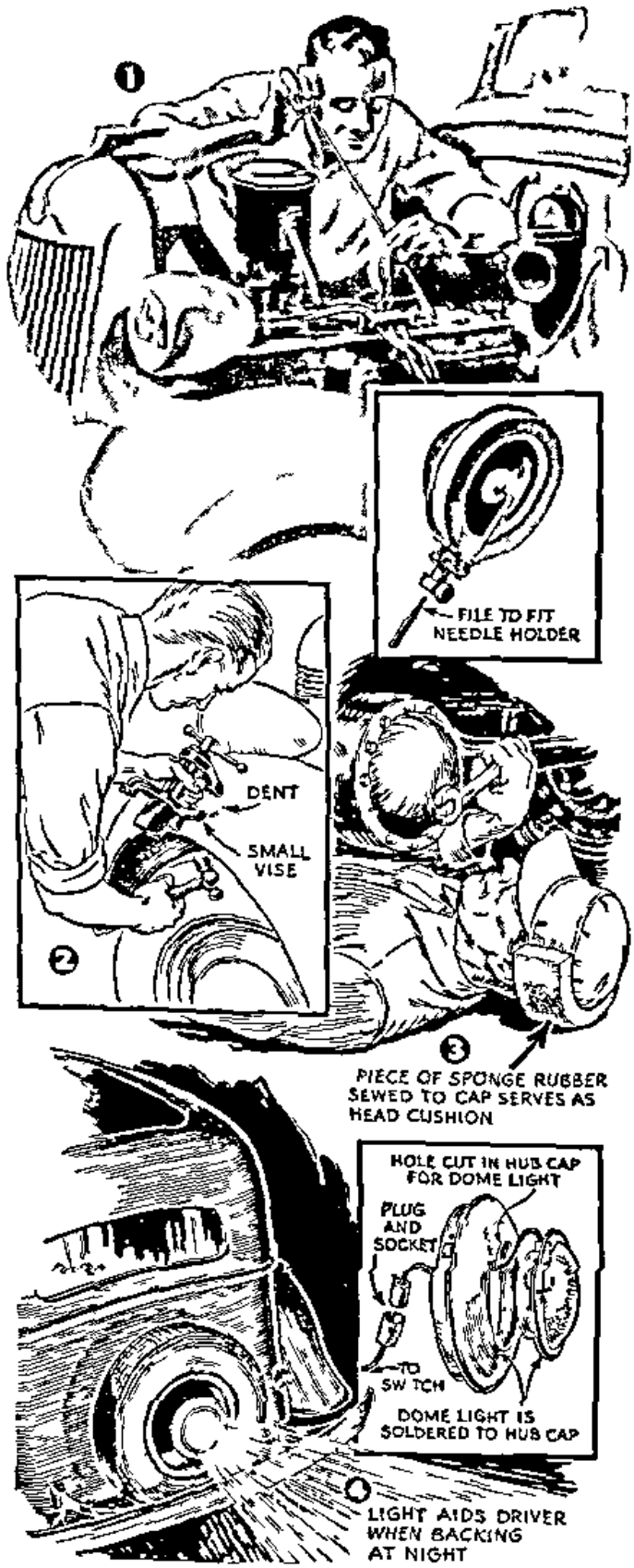
EIGHT CAR TIPS FOR

1 A HOMEMADE STETHOSCOPE for diagnosing motor ills is easily assembled from the reproducer head of an old phonograph arm and a length of ⅛" steel rod 18" long. File one end of the rod as shown in the inset at right to fit the needle holder. Holding the reproducer up to the ear and moving the other end of the rod around on the engine block will quickly locate most engine noises.—C. O. M.

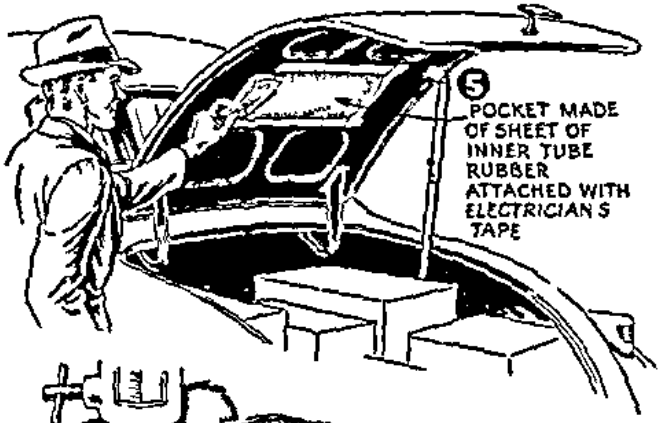
2 REPAIRS TO DENTED FENDERS are facilitated with an ordinary small bench vise used as illustrated at the right. First the vise jaws are opened wide and placed against the top of the fender so that the dent is between them if small and along their edges, if large. Tap the underside of the fender with a hammer to bring it back to shape. Shifting the jaws of the vise around the dent improves the job. By turning the vise in various positions its rounded jaws can be made to conform to the fender curves.—R. J. W.

3 FOR WORKING UNDER A CAR a piece of sponge rubber about 1" by 3" by 8" in size sewed onto the back of a mechanic's cap provides a soft cushion wherever he rests his head. Besides providing comfort the cushion will eliminate any possibility of bruises and cuts should a slipping tool or dropped part cause the worker to jerk his head backward and downward against the floor.—N. B.

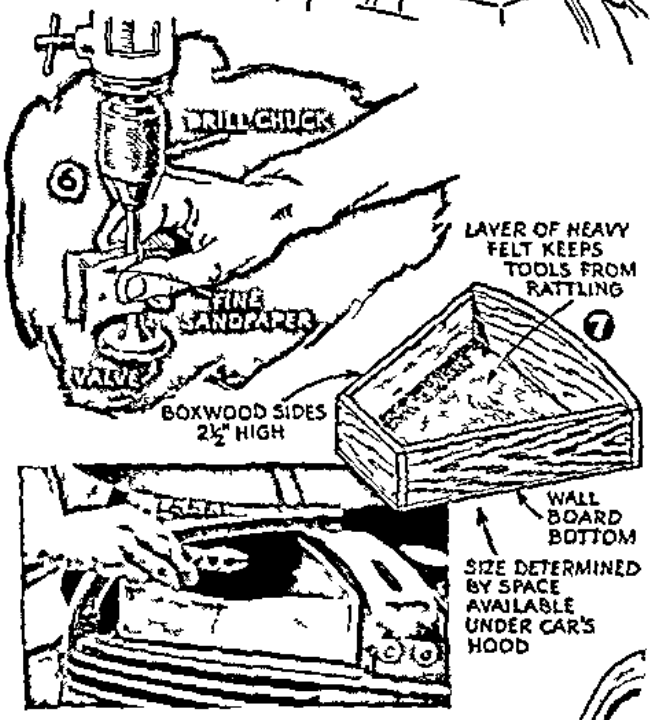
4 BUILT INTO THE HUB CAP OF a rear mounted spare wheel an old dome light obtained from a junk yard can be a serviceable and decorative backing light for your car. Cut a circle in the hub cap large enough to take the fixture to which a single wire lead and plug are attached. Then solder the fixture to the cap to hold it and provide a ground. Connect a wire from the socket by means of a plug and long wire to a switch on the dash and thence to one ammeter terminal. When you change a tire switch the hub caps too so as to keep the light on the rear of the car.—S. A. T.



AMATEUR MECHANICS



5 SALES RECORDS AND OTHER data are stored close to a salesman's samples under the deck of his business coupe if the device shown in the accompanying sketch is used. A sheet of inner-tube rubber fastened to the underside of the compartment lid with strips of electrician's rubber adhesive tape, as indicated, will keep all papers clean, handy and dry. Motorists other than salesmen will find such a pocket useful for storing booklets, spare maps and other papers not needed continuously in the front seat.—G E H



6 RIDDING VALVE STEMS OF carbon and oil varnish can be accomplished speedily by simply inserting each valve stem in turn in the chuck of a drill press, turning on the drill and holding a strip of fine sandpaper lightly against the stem as it spins. Do not let the sandpaper touch the faces of the valves.—H J

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7 SET UNDER THE HOOD IN THE unused space up ahead of the radiator in many cars a tool box made as shown at the left is extremely handy. I made one for my car out of box wood with a bottom of ordinary wall board. A felt lining in the bottom keeps the tools from rattling. Naturally, the shape and dimensions of the box are determined by the space available in your car.—A E O



8 DRYING A CHAMOIS QUICKLY and often while putting the finishing touches on a car wash is a tedious operation when it must be done by hand. I found that an old clothes wringer could be used to cut the work down considerably. Whenever I wash my car, I clamp the old wringer on the end of the front bumper and set my rinsing pail in front of it. As often as necessary I souse the chamois in the water and run it through the wringer. At some spot on the rear or front bumper of nearly any car, space can be found where the wringer can be clamped. Otherwise any convenient support located near the scene of operations can be utilized.—L J E

SPEED

By EDWIN TEALE



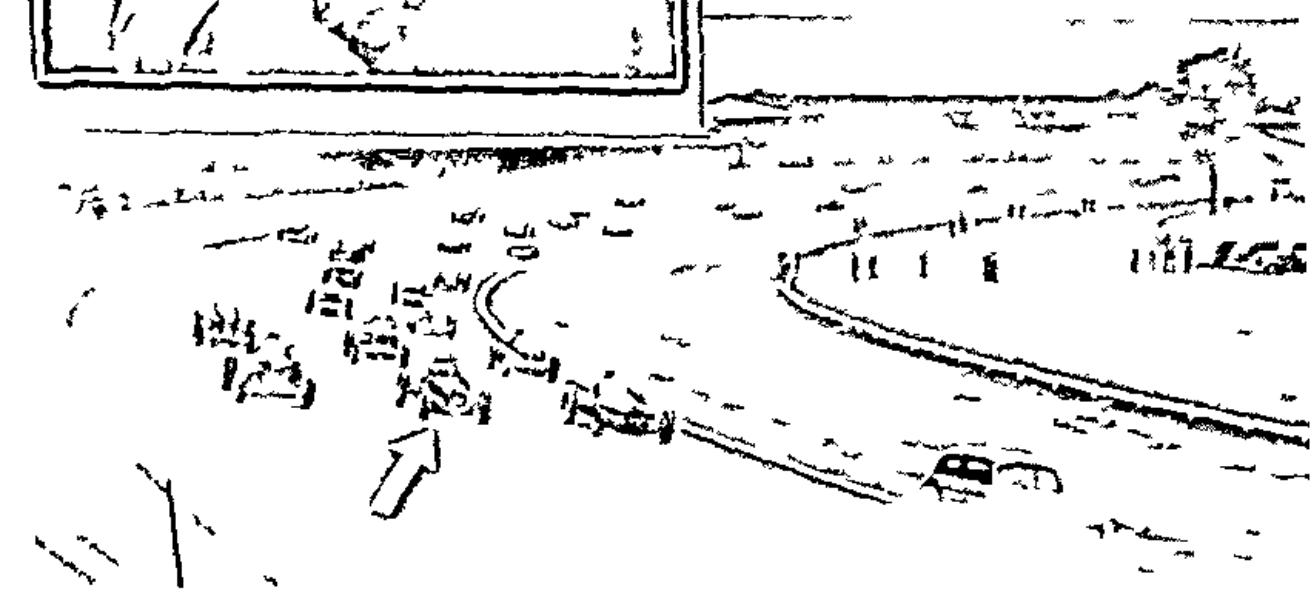
Wilbur Shaw, ace speed demon at his racer's wheel

AMERICA'S most spectacular example of a home town boy who has made good—at home—is Wilbur Shaw

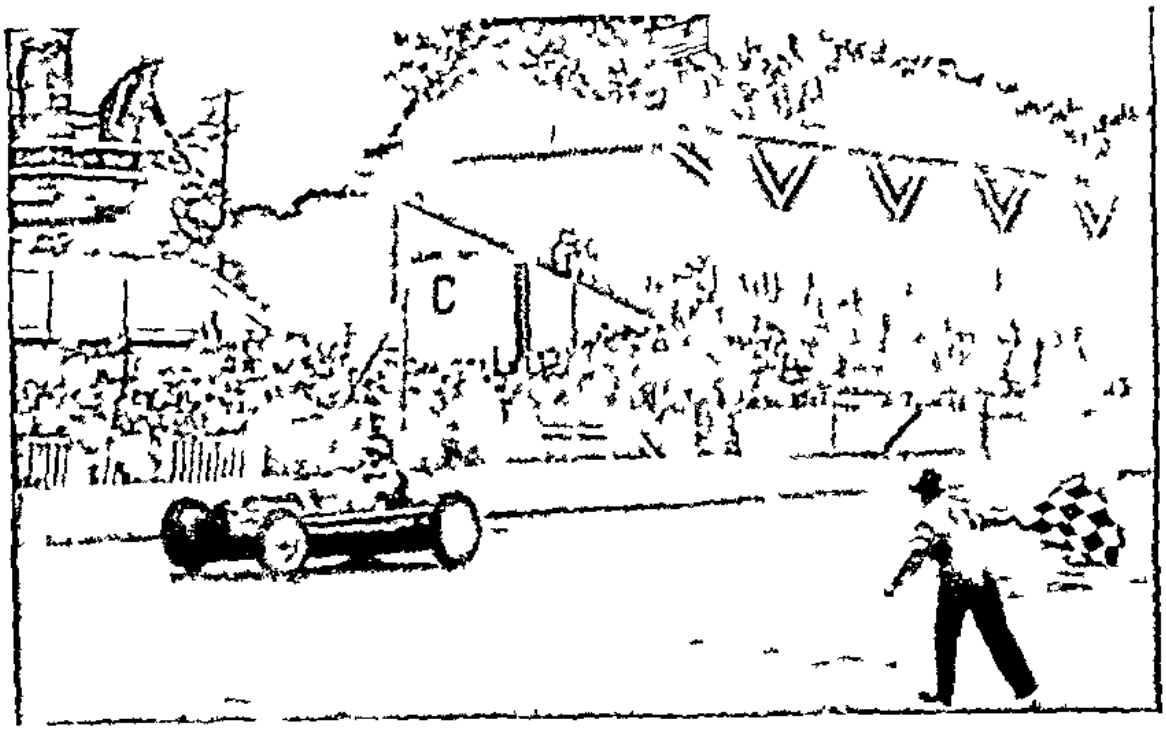
When his low slung Maserati racer, slashing through rain flicked past the checkered flag at the end of the 500 mile Indianapolis classic last Memorial Day it carried him to undisputed position as ace of the racing drivers Three times and twice in succession he has led the field across the finish line He is the greatest



Rolling off the track into the bull pen reserved for the winner Below the start of the 1940 Memorial Day classic, Shaw is at the center of the first rank of cars



IS HIS BUSINESS



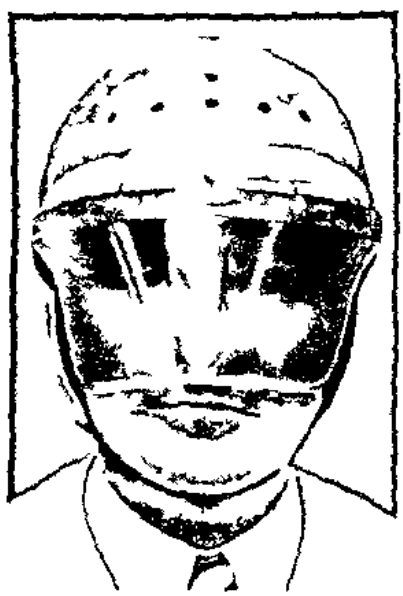
Und sputed k ng of the speedway Shaw crosses the F n sh l ne for h s th rd Ind anapol s v ctory

WILBUR SHAW, Three-Time Indianapolis Winner, Has Raced 40,000 Miles to Success

money w nner in the annals of the historic track The brick oval on the outskirts of the Indiana city has proved a $180 000 gold mine for Indianapolis s car crazy kid who used to pedal his bicycle fourteen miles just to catch a glimpse of his he roes thundering into banked turns on practice spins

If some one had followed Shaw around with a candid camera recording in snap shots the most dramatic events of his life the first p c ture would show a cloud of dust ris ng from a gravel road in the year 1910 Just in advance of the cloud was Wilbur Shaw steering his first automobile at the age of seven Scorch ng along at twelve miles an hour he sat on the lap of a neighbor gripping the wheel of a p o neer Cole 8 and peering through the earliest of wind shields a circular p ece of glass clamped to the steering post in front of the driver

That early dust cloud was symbolic Shaw has been rais ng the dust ever since and has been go ng faster and faster in the process



By the time he was ten he was spending so much time at the speed w ay that even the drivers knew him He still re members the thrill he got when the first of these kings of the roaring road spoke to h m I wanted to drive a racing car so badly he recalled w hen I talked to him the other day in Indianapolis that I could almost taste it

F rst Amer can dr ver to wear a crash helmet he now also uses a po la zed l ght v so to k ll glare on the track

TEN DRIVERS I'M AFRAID TO RIDE WITH——

Wilbur Shaw

1 THE INDECISIVE DRIVER

He can t make up his mind is too slow on the trigger starts to do this and then changes to something else gets flustered in an emergency

2 THE COMPETITIVE DRIVER



He sticks out his jaw and steps on the throttle whenever a car starts to pass tries to beat the train to the crossing is always ready for a race with anyone anywhere any time thinks every highway is a speed way takes dangerous chances to win.

3 THE SEE HOW GOOD I AM DRIVER

He is always showing off his skill at the wheel trying to impress his passengers give them the thrill of their lives sees how close he can come to telephone poles and how fast he can make the turns.

4 THE SLEEPY DRIVER



He drives himself as well as his car keeps on after he should stop dozes at the wheel and comes to with a start thinks he hasn t time for a stop by the side of the road and a short catnap a pause that may save his life

5 THE WEAVING DRIVER

He spends half his time on the wrong side of the road weaves in and out of traffic cuts around other cars and ducks back in line just in time to avoid a head-on collision.

6 THE TOO OBSERVANT DRIVER



He keeps looking back at cattle in pastures crops in fields pretty girls on the sidewalk watches everything but the road ahead enjoys himself without ever realizing his danger

7 THE JERKY DRIVER

He can t keep a steady pace goes fast for a while then slows down without respect to road conditions snarls up traffic and prevents other cars from hitting an even pace

8 THE DRINKING DRIVER

He always thinks everything is under control that he is better than he is speeds and takes chances without realizing it

9 THE TALKATIVE DRIVER



He can t decide whether his conversation or his driving is most important Keeps turning around to see if the passengers in the back seat are listening

10 THE PREOCCUPIED DRIVER



He has something on his mind is always concentrating on something besides his driving comes to with a start just as he is heading for the ditch a fire hydrant or a lamp-post

At seventeen he quit school to drive for Bill Hunt a local manufacturer of dirt track racers His machine however wasn t one of Hunt s hundred mile an hour speedsters It was a pick up truck rolling about the streets of Indianapolis on errands Every time the youthful Shaw discovered an automobile part nobody wanted he cleaned it up and put it in a special pile of his own in one corner of the garage Finally he had enough parts to fit together into a racing car About this time one of Hunt s drivers demolished his machine in a race at Winchester Ind Shaw got the motor and his home grown racer was complete

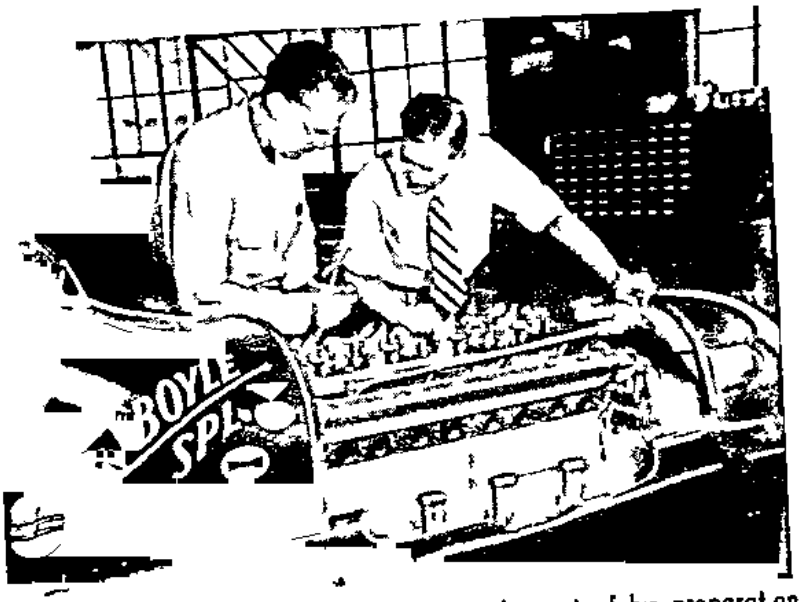
It showed plenty of speed But it also showed plenty of mechanical bugs No sooner was one defect ironed out than another appeared To this day Shaw refers to it affectionately as the world s worst

bag of bugs On July 4 1921, at the half mile dirt track in Lafayette Ind, eighteen-year-old Wilbur Shaw shot away at the start of his first race 'Cotton Henning now his head mechanic was one of the competing racers At the end of two laps Shaw, hitting a turn wide open went straight out through the fence crashed rolled like a ball and got to his feet un hurt. The other Hunt drivers helped him hammer out the bent places in his car and get it rolling again after the meet was over Then they all raced back to Indianapolis just for the fun of it'

Tearing down fences at various tracks in the Middle West kept Shaw busy the rest of the summer He had a racing heart without the skill of experience He tried to hurl his car into every turn with the throttle against the floor boards Usually before the end of a dozen laps he had disappeared from the track in a cloud of splinters But, each time, the young "fence buster" escaped injury In preparation for racing, he had practiced tumbling and gymnastics so he could fall and roll without breaking bones In addition, whenever he saw a crack-up coming he "went to the basement," sliding down as far as possible into the cockpit to get maximum protection. All told Shaw has been in more than 200 crashes Yet he never has been seriously hurt. Today, after nineteen years in the racing game he is unscarred Athletic and clean-cut, he looks as though he had been cast in the role of racing driver by a Hollywood director



Before the start of a race Shaw has a parting word with Cotton Henning his head mechanic Henning was a rival in Shaw's first race



Here he is inspecting the Maserati motor As part of his preparation for a contest he helps tune the car to as near perfection as possible

By the end of that first summer, the boy driver was demonstrating that he was a 'natural The season ended in a blaze of glory At the old Hawthorne Track, in Chicago, his bag of bugs led the field to carry off the coveted Bernbach Trophy There followed years of dust eating at leading tracks throughout the country During one race, at Detroit, dusk closed in before the contest ended and when one car went out through the fence Shaw saw two others fol-



Shaw wipes dust off his visor with a piece of chamois tied to the steering wheel by an elastic cord In the photo below Shaw shows how he holds the wheel during the gruelling five hour grind of the 500-mile race class c





The photo at the left shows the crash button on the wheel for cutting the ignition if a crash is threatened

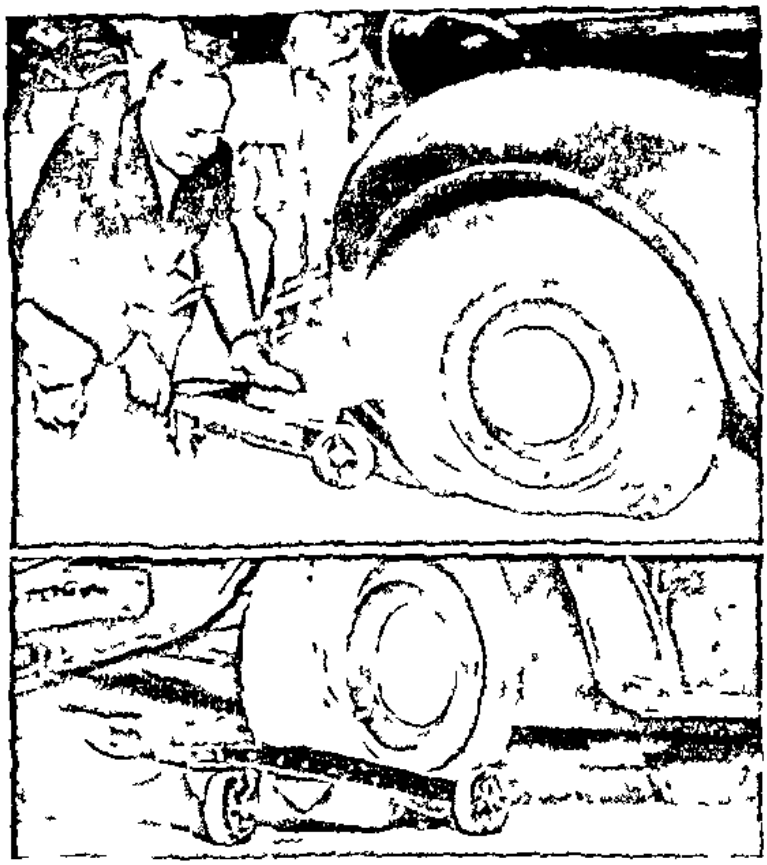
low it like sheep Another time at Peru, Ind. the 100-mile speed battle was fought during a snowstorm with the white flakes striking the faces of the drivers like birdshot. By 1929 Shaw was at the top of the game In eleven championship races he carried off nine firsts. The American Automobile Association named him the year's National Dirt Track Champion of the United States.

Two years before that, in 1927 he had achieved his boyhood goal When the varicolored cars roared down the brick straightaway at the start of the Memorial Day race Shaw was hunched over the wheel of one of them. Screeching along the surface of the 3 200 000 bricks that form the vast, banked oval, he fought his way past veteran drivers and landed in the money placing fourth.

Year after year since then, Shaw has been one of the thrill drivers of the historic track In the last four races he has come in first three times and second once In the last seven races, he has averaged more than 100 miles an hour without the aid of a relief driver Counting both trial runs and races Shaw has chalked up more than 20 000 high speed miles at the Indianapolis oval

In preparation for a race he trains like a track athlete He eats light meals Breakfast, for example consists of bouillon and bread and milk. This year he tried taking gelatin for three weeks before the race as an aid to stamina, and believes it did him good. The constant vibration of the rocketing cars leaves the drivers sore from head to foot at the end of a 500-mile grind. During the four hours and twenty four minutes it took to complete the 1937 race Shaw had eleven pounds hammered off by the jarring of the brick bowl.

In the saga of this speedway some of the outstanding mo- *(Continued on page 239)*



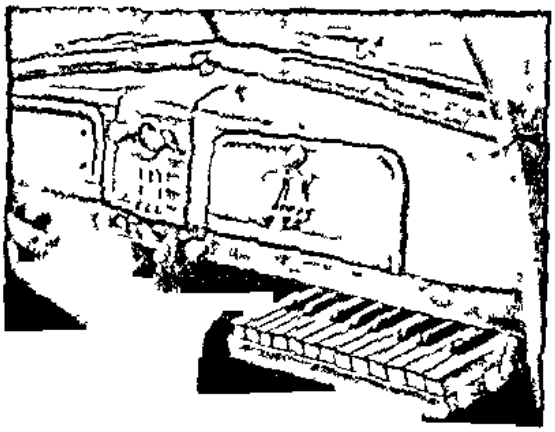
In the upper picture Larry Kieffer demonstrates the use of his car crutch which holds a flat tire off the road until it can be changed

Dolly Spares Flat While You Drive to Nearest Garage

THE dilemma of motorists—whether to change a tire and soil a good suit or drive the flat to a service station and risk ruining the tire—seems to have been solved by a simple device produced by Larry Kieffer, of Philadelphia, Pa It is a lightweight, three-wheeled dolly which can be carried in the luggage compartment of any car In case of a flat, the dolly is placed in line with the wheel and a spiked bolt is screwed down to engage the surface of the road and prevent the dolly from moving Then the wheel is run up into the cradle of the dolly, which holds the injured tire from contact with the ground during the drive to the nearest service station or garage A swivel wheel makes steering possible.

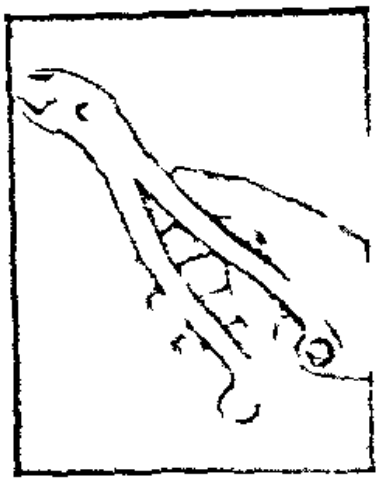
Dashboard Keyboard Operates Car-Exhaust Calliope

UNDER the hood of the automobile owned by Leo Feuchter, of Ironton, Ohio, is a homemade calliope which is powered by the exhaust of the engine and played by means of an organ-type keyboard at the right side of the dashboard Depending upon the speed at which the motor is running, the sound of the calliope can be heard from six to eight blocks away. To start the music, the operator presses a pedal, diverting the exhaust gases into the instrument The range of the calliope is two octaves. Feuchter, a sixty-five-year-old automobile mechanic, designed and constructed the unique installation, which has attracted wide attention in parades and at conventions





Calliope pipes installed under the hood of a car Played with the two octave keyboard seen at the left, the instrument uses exhaust gas

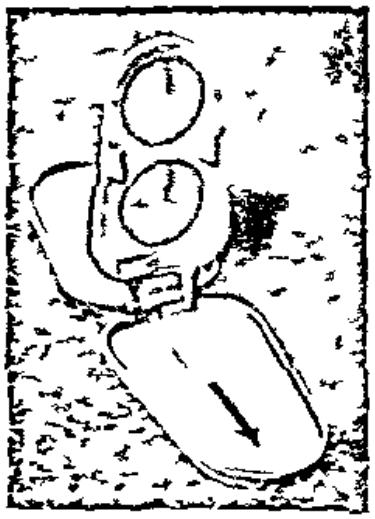


Battery Pliers and Terminal Wrench Are Servicing Aid

TWO tools in one are provided *for the service man* by a new pair of battery pliers shown in the illustration above. The angle of the jaws enables the pliers to grip corroded or damaged battery terminal nuts, while at the end of each handle is a box wrench opening one 5 inch and the other 9 16 inch, for use with noncorrosive-type terminals. The new drop forged triple plated tool is made of chrome-vanadium steel.

New-Type Reflector Is Flameless Flare for Stalled Vehicles

MOLDED reflectors that give off a brilliant red warning light when struck by beams of the headlights of an approaching car are now available for use as "flameless flares" behind stalled trucks or automobiles. The discs of plastic material are contained in a metal housing with hinged covers.



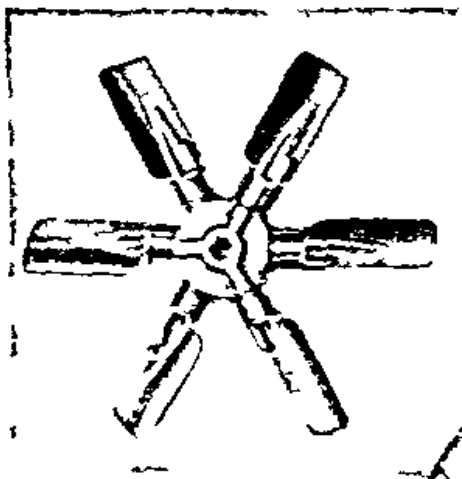
Set behind a stalled vehicle the reflectors flash red in the beams of oncoming cars headlights



Spray Gun To Reach Car Squeaks Fits on Oil Can's Screw Top

ELIMINATING car squeaks is simplified by the use of a new spray gun which fits any standard screw top can of oil and throws a fine stream of the lubricant as far as the entire length of the car. The inverted feed system enables the spray gun to use the last drop of oil in the can. The fact that the can is directly over the handle of the unit makes the gun easy to operate the manufacturer declares.

Variable-Pitch Fan Blades Control Heat of Car Motor



Two of the new fans, showing the variable-pitch blades controlled by a thermostat in the radiator

VARIABLE PITCH blades on a new automobile cooling fan are adjusted automatically by thermostatic control to increase or decrease the amount of air drawn through the radiator according to the needs of the cooling system. The thermostat, responsive to the motor temperature, varies the angle of pitch of the blades to keep just the right amount of air flowing to maintain the motor at a predetermined temperature. If no air flow is required to cool the radiator water the blades of the fan flatten out and spin idly saving power and fuel. The new thermostatic fan, available with either four or six blades, has been designed so it can be installed on many car motors.

HOME *and* WORKSHOP

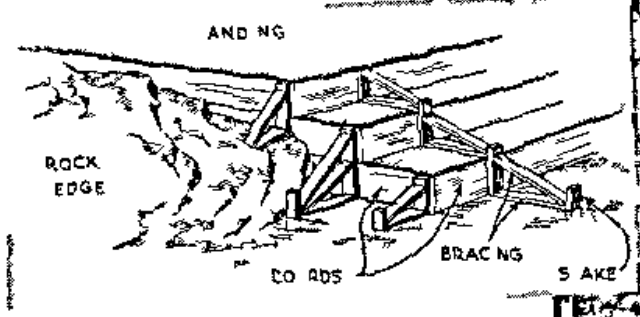
Masonry Repairs That Save You Money

- ***Laying Out a Shop for Small Work***



Masonry Repairs

By JOHN MODROCH

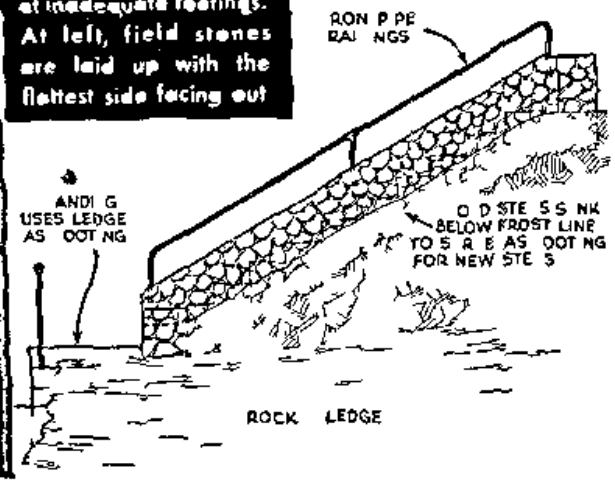


Method of p o ng fo m fo conc ete steps





Rebuilding steps that had collapsed because of inadequate footings. At left, field stones are laid up with the flattest side facing out



EVERY home seems to requ re masonry repa rs from t me to t me Many of these are so s mple that any handy man can undertake them successful ly It is necessary of course to know how to mix concrete and mortar for various purposes and th s is covered n a tabulation on a follow ng page It is also important to understand the general procedure for vari ous types of repairs Ind v dual jobs all differ but the accompanying illustrations show how to solve a number of common problems confronting an amateur mason

When repairs are made necessary by lack of a sol d underground foundation the first thing to do s lay an adequate foot ng for the new masonry This usually calls for d gg ng a sheer sided trench to the requ red depth into wh ch a mixture of concrete and large stones is poured

In m ld localities the footing need not go very deep but where long cold winters pre ail a depth of several feet is necessary To be on the safe side foot ngs should start below the lowest possible frost l ne or depth to wh ch the ground freezes It is custo

That Save Money

mary on small projects to extend the foot ing several inches beyond the width and length of the structure Use can sometimes be made of large buried stones and rock ledges as solid footings for masonry work

The steps illustrated formerly ran down the slope in a long straight line When ex tensive repairs on them became necessary because of their badly cracked up condition they were rebuilt so that adequate footing could be provided In order to make use of a buried rock ledge that lay under the lower end they were redesigned into the shape of a T with the ledge serving as footing for the landing The old cracked steps were then sunk into the slope to provide footing for the new steps built over them

Common field stone of which the greater part of this step project was built can be laid up to best advan tage in the manner shown in one of the photos The flattest surface of each stone should face out Splitting stones to give them a flat face can be done quickly with a mason s hammer or sledge and in certain cases with the aid of a cold chisel Ordinary ham mers and axes should not be used

Retaining walls such as those flanking the lower flights of steps should be laid with a slight backward tilt in order to increase their stability A back fill of loose stone can be thrown in behind the cemented facing to add further retaining strength to the wall

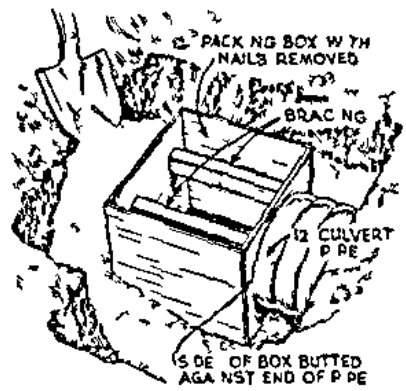
If large flat field stones are not available cut flagstone of the kind usually sold for walks and terraces may be used for laying a smooth tread on stone steps

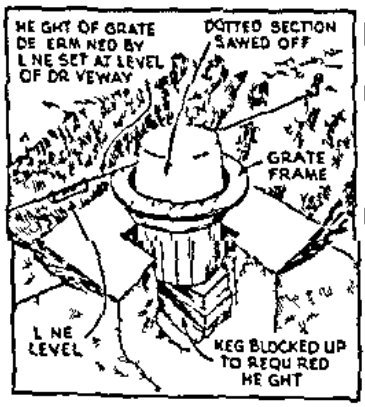
When concrete steps must be cast on the sloping side of a rock ledge wooden forms of the type commonly used for casting steps should be prepared as shown in drawing

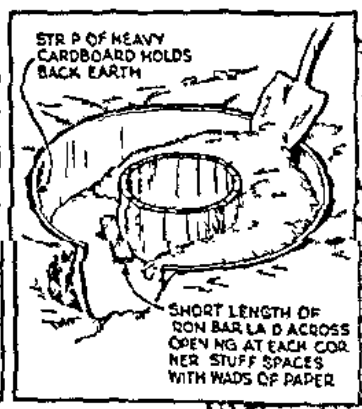
Wooden forms for casting concrete should be built of green lumber or boards well

DRAINAGE BASIN FOR DRIVEWAY

A bas n of th s type should be located at the lowest po nt and the surface of the road p tched toward t The lower part of the bas n s cast square as at r ght but the upper part s c rcular in shape

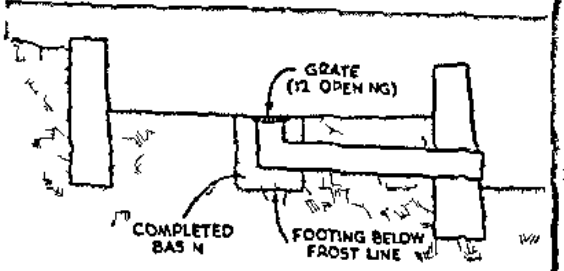


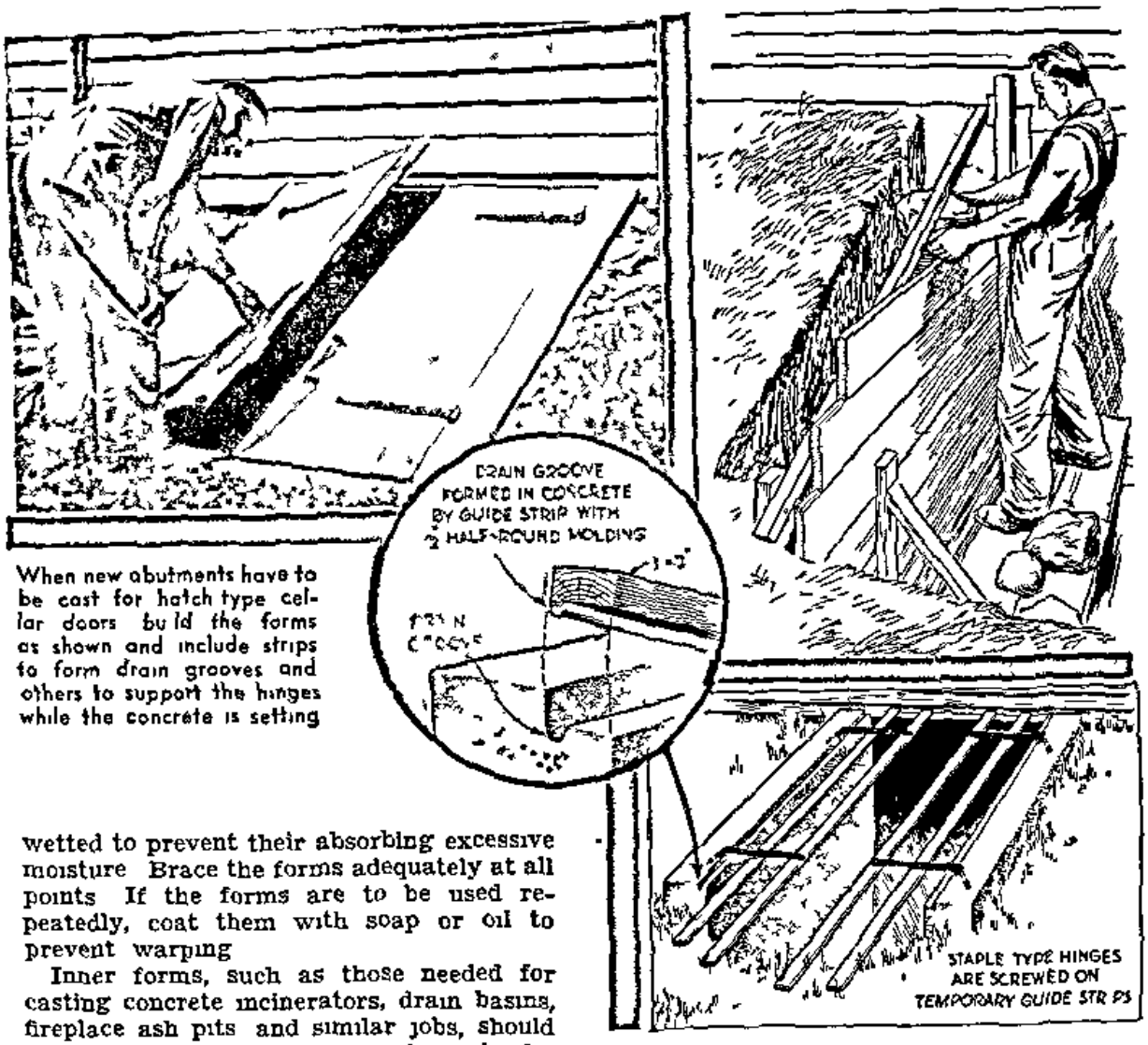






Below cross sect on of h lls de dr ve w th bas n





When new abutments have to be cast for hatch type cellar doors build the forms as shown and include strips to form drain grooves and others to support the hinges while the concrete is setting

wetted to prevent their absorbing excessive moisture Brace the forms adequately at all points If the forms are to be used repeatedly, coat them with soap or oil to prevent warping

Inner forms, such as those needed for casting concrete incinerators, drain basins, fireplace ash pits and similar jobs, should be made collapsible Two simple tricks for doing this are illustrated

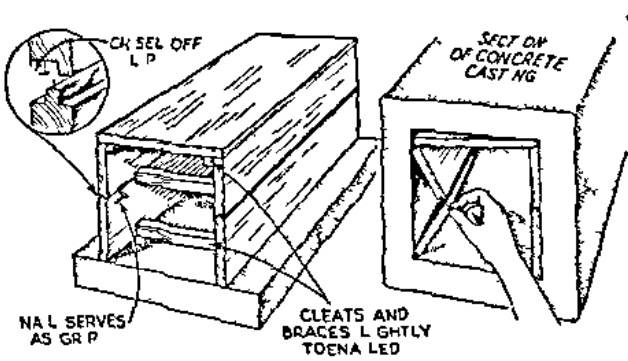
In some cases it is not necessary to make all walls collapsible The buckling of two opposite walls will free the adjacent walls—or the third wall and ceiling depending upon the type of form being used. All sections of the collapsed form must, however, be small enough to be pulled out of whatever opening exists

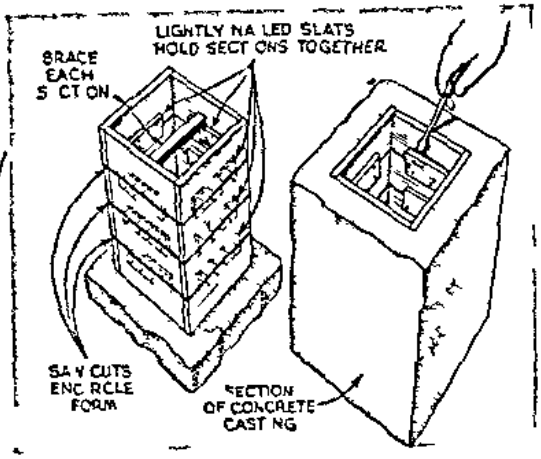
Short cuts in assembling inner forms are often possible For example, a 12" square packing box and part of a common nail keg were combined to make up the inner form used for casting the hillside driveway drain basin illustrated The bottom section, it will be noted was cast square in order to make a suitable joint with the 12" drain pipe while the top section was cast round to make a good bed for the frame of the round grate

The strength of concrete mixtures varies with the cleanliness of sand, gravel and stone and other aggregates mixed with the cement and water The presence of top soil and other impurities prevents the cement from completely coating every particle of sand and aggregate In other words very clean sand and aggregate require less cement to form a concrete suited for a given job than sand and aggregate containing impurities

Fine textured concrete should be made by first mixing dry cement with dry sand and then adding the required amount of water When making coarse concrete, however, it is easier to mix in the heavier aggregate, such as coarse gravel, crushed rock or cinders after the cement, sand and water have been mixed into a batter Then add more water to readjust the liquid content of the batch It is customary when recommending the proportions of cement, sand, and aggregate for mixing a given class of concrete to use three figures as 1 2 5

The body of a discarded wheelbarrow set into the top of a sturdy knee high stand built of scrap wood makes a handy set up for mixing concrete required for ordinary home repair jobs Its convenient height eliminates the back strain that goes with





Two types of collapsible inner forms for casting concrete No nails are used except where indicated

mixing on the ground and if used indoors the floor under it can be swept up regularly Of course a wooden box can be substituted for the wheelbarrow body

Mixtures recommended for various general types of concrete work are given in the two tables Either table can be followed accurately by using a box for measuring the amounts of cement, sand, and aggregate in the proportions called for

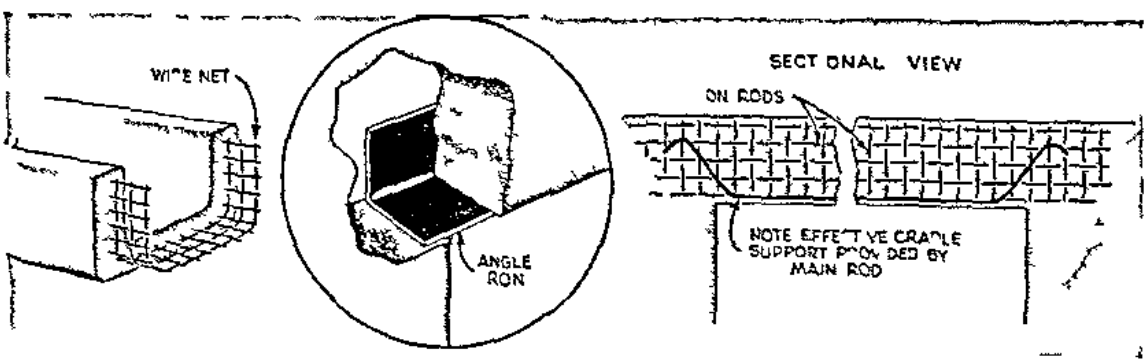
In order to add just the right amount of water to the dry mix if Table No 2 is used it should be added carefully a little at a time Meanwhile the mixing should be continued When the concrete becomes pliable like a batter it is ready Any excess water in concrete reduces its strength When following Table No 1 the water must of course be measured beforehand

Stones of various sizes can be dropped into the form along with concrete when casting abutments such as those supporting the hatch type cellar doors To avoid rotting of the wooden sills commonly used as hinge bases for doors of this kind it is a good idea to eliminate them and anchor the hinges in the masonry

HOW TO MIX CONCRETE FOR ANY PURPOSE

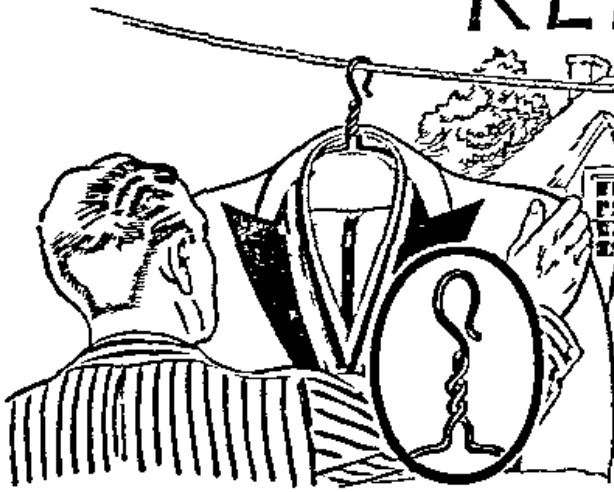
Type of Work	Table 1			Table 2		
	Cement	Water	Ordinary sand gravel	Cement	Sand	Aggregate
Class A Concrete exposed to severe action of water frost and wear—posts and drives	1 cu. ft	4½ gal	Add enough to make approx 3 cu ft of concrete	1	2	3
Class B Concrete exposed to moderate action of water frost alkali and wear steps and septic tanks	1 cu ft.	5½ gal	Add enough to make approx 4 cu ft of concrete	1	2	4
Class C Concrete protected from action of water frost and alkali—retaining walls and foundations	1 cu ft	6½ gal	Add enough to make approx 5 cu ft of concrete	1	2½	5
Class D Low strength concrete—foundation footings	1 cu ft	7½ gal	Add enough to make approx 6¼ cu ft	1	3	6
	1 bag of cement 1 cu ft.			Add water as required		

Use 1 part cement 3 parts sand 1 part lime as a mortar for brick tile stone Use a 1 2 mix for the finishing coat on two course work

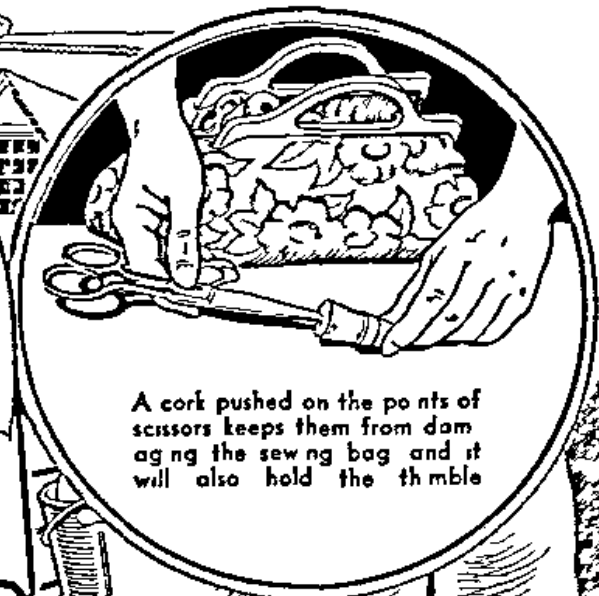


Methods of reënforcing concrete (1) tanks and troughs (2) over openings (3) when used for beams

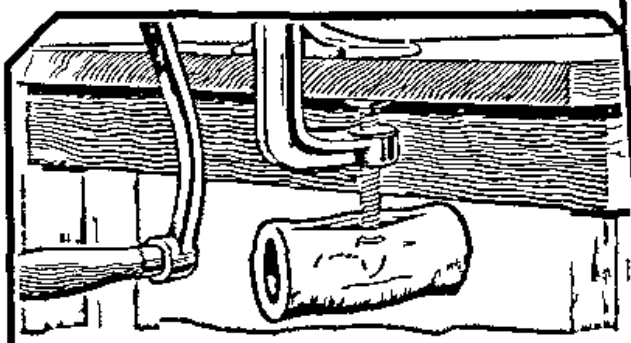
KEEPING THE



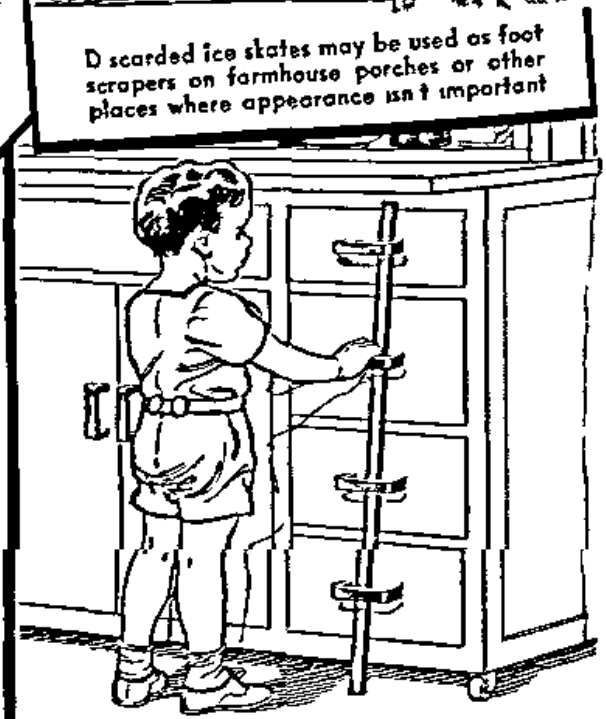
By bend ng the hook of a w re coat hanger into the shape of the letter R you can snap t on the clothesl ne and the wind cannot blow it off



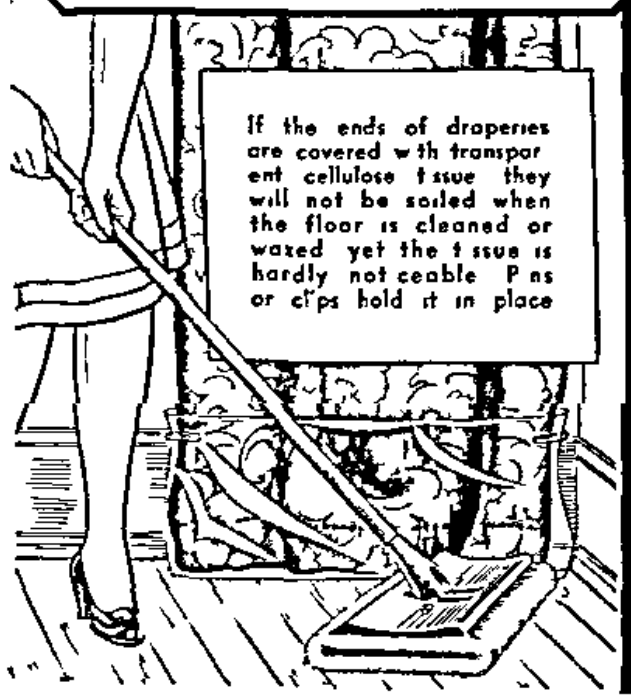
A cork pushed on the po nts of scissors keeps them from dam ag ng the sew ng bag and it will also hold the th mble



T ghten ng the thumbscrew on the food chopper is made eas er by cutt ng a slot in a p ece of garden hose so that it f ts over the screw



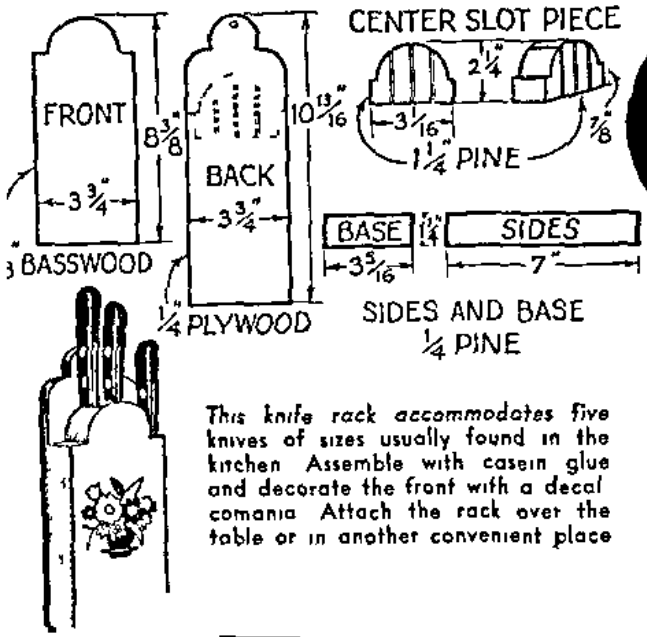
D scarded ice skates may be used as foot scrapers on farmhouse porches or other places where appearance isn t important



If the ends of draperies are covered w th transpar ent cellulose t ssue they will not be soiled when the floor is cleaned or waxed yet the t ssue is hardly not ceable P ns or cl ps hold it in place

To prevent a small ch ld from opening drawers in the k tchen and obtain ng knives and other implements when mother is not around drop a st ck through the handles and he will be safe

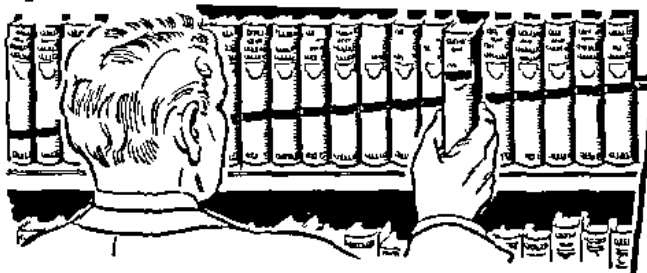
HOME SHIPSHAPE



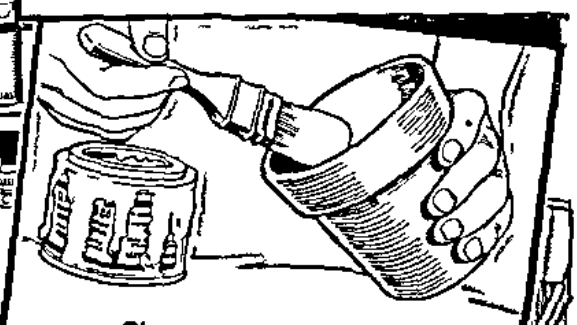
This knife rack accommodates five knives of sizes usually found in the kitchen Assemble with casein glue and decorate the front with a decal comania Attach the rack over the table or in another convenient place



Large corks drilled and slotted may be fitted over the bail of a cooking kettle to *hold the lid while draining off the water*



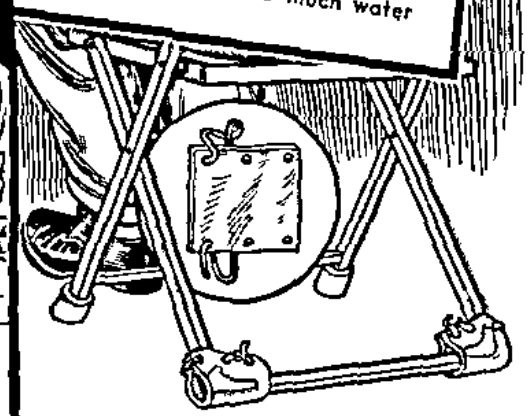
A diagonal stripe painted across an encyclopedia set immediately shows when a volume is misplaced



Clay flowerpots can be used for house plants if the insides are painted. This prevents the pots from absorbing too much water



The water heating coil won't wear out as quickly if T-connections are substituted for elbows The plugs can be unscrewed and sediment removed with a bent wire



Leather 'shoes' will keep the rear legs of metal folding chairs from damaging the carpet or floor Rubber crutch tips can be fitted over the front legs

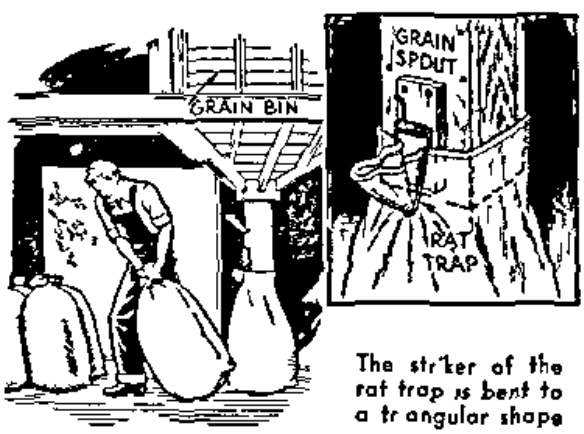


Printing Ink Applied with Grease Gun

TO SIMPLIFY the use of a cheap ink for posters and other rough printing one printer keeps the ink in a grease gun the tip of which is fitted with a short length of rubber tubing As the ink is forced from the gun the hose is employed to spread it smoothly over the plate —G E HENDRICKSON

Rat Trap Holds Grain Sack on Spout for Filling

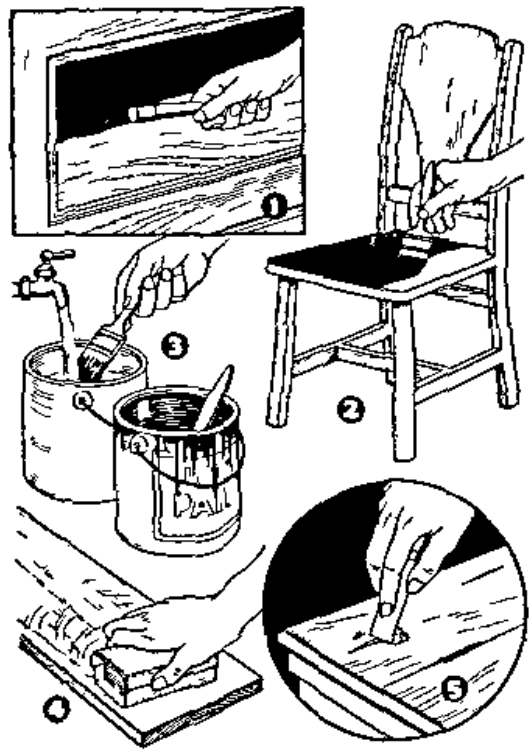
FILLING sacks of grain from an ordinary grain bin can be hastened by making use of the method illustrated for holding the sack on the spout A large rat trap of the ordinary back breaker type is nailed on one side of the end of the spout after the striker wire has been bent to the triangular shape shown To fasten a sack, lift the elongated striker and pull the lip of the sack through it The spring tension will keep the sack in place—E G



The striker of the rat trap is bent to a triangular shape

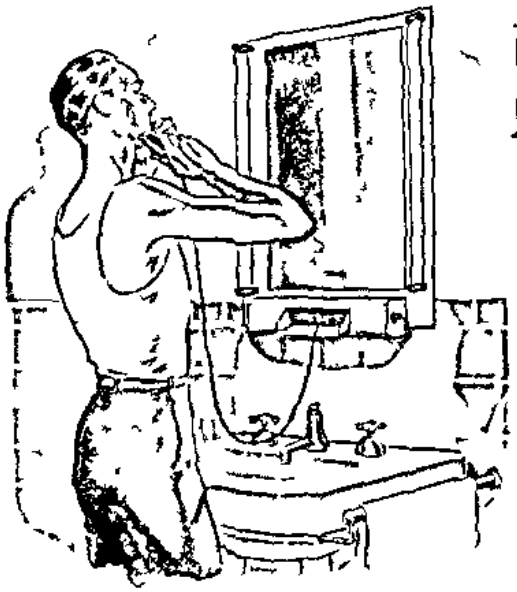
What's Wrong IN THESE SKETCHES?

INEXPERIENCED painters make many mistakes some of which are illustrated below Can you spot them? Figure 1 shows how an amateur started to paint some panels on his sun porch In Fig 2 he is painting a chair He always makes a practice of washing his brushes after use and keeping them in a can of water (Fig 3) In Fig 4 he is sanding the top of a small table Whenever he finds bad dents that have to be filled with putty *he applies the putty as in Fig 5* His mistakes are explained below but try to discover them for yourself



1 The moldings should be run in first from corner to center then cut in the panels with left to right strokes The brush is too small and improperly held Hold it as in Fig 2 for proper balance and flexion of bristles and wrist 2 Start with the underparts first end with the surfaces that are seen the most 3 Clean brushes in the proper solvent and put away in a brush keeper (not water) so the bristles hang clear of the bottom of the can 4 Don't use a whole sheet of sandpaper wrapped around a block but a quarter sheet preferably held on a sponge rubber faced block about 1¾" by 3" by 5" Sand in straight lines only with the grain of the wood 5 Select a flexible putty knife and use the fingers of the left hand to press down the blade so as to smooth the putty to a flat level surface Two hands are needed for it a

$100 IN CASH PRIZES FOR The Ideal Medicine Cabinet



IF YOU were given the job couldn t you design a better medicine cabinet than the one you have in your bathroom at home? We know you ll say "yes," so we challenge you to try it And to stir up a little *friendly competition* we will award the following cash prizes for the best designs submitted

FIRST PRIZE	$50
SECOND PRIZE	25
THIRD PRIZE	15
FOURTH PRIZE	10

Plan the cabinet to hold standard remedies such as those in the accompanying list, as well as toilet articles, prescriptions, and other essentials It may be of any materials, with or without illumination, but should be of reasonable size and of such construction that any competent amateur craftsman could build it without difficulty

Make a clear, dimensioned pencil drawing or sketch of the design, and prepare a list of materials and brief description If you have actually built the cabinet, send a good photo as well Mail your entry to the Contest Editor, POPULAR SCIENCE MONTHLY, 353 Fourth Avenue, New York, to arrive on or before November 30, 1940 The contest judges will be the editors of this magazine, whose decision will be final No entries will be returned In case of ties, each tying contestant will be awarded the prize tied for The contest is open to all except employees of this magazine

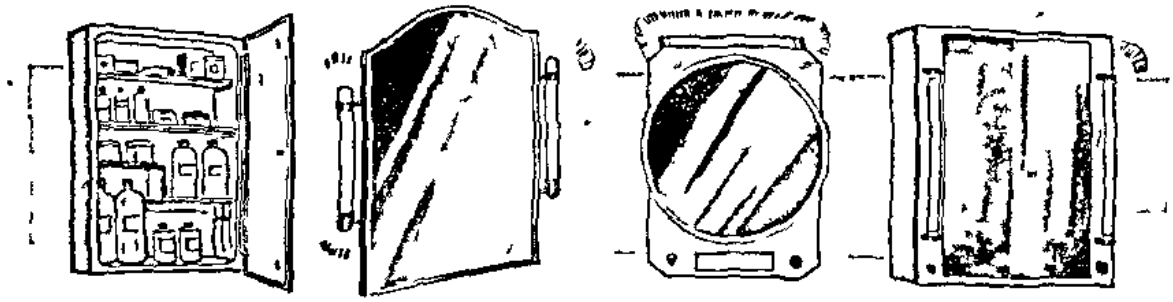
WHAT THE FAMILY MEDICINE CABINET SHOULD CONTAIN

The following list is based upon recommendations of the United States Department of Labor in a booklet, The Home Medicine Cabinet

Toothbrushes • Tooth paste powder, or liquid • Scissors
Shaving essentials • Rubbing alcohol • Boric acid powder
Tincture of iodine • Aspirin • Aromatic spirits of ammonia
Tannic acid powder • Petrolatum • Sirup of ipecac • Tweezers
Dental floss • Sodium bicarbonate • Clinical thermometer

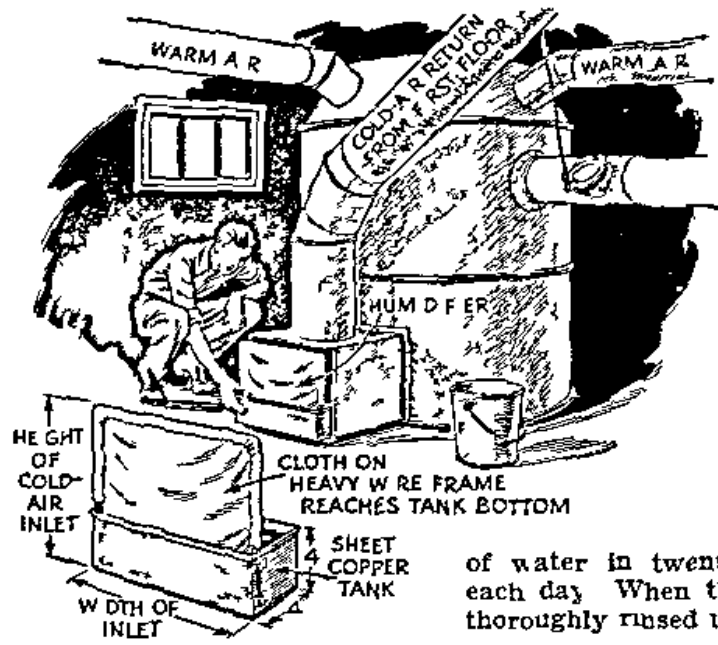
FIRST AID DRESSINGS 12 assorted bandages roll of sterile gauze roll of adhesive plaster, roll of absorbent cotton

ONE OF THESE Mineral oil mineral oil emulsion cascara sagrada milk of magnesia sodium phosphate, castor oil



The cabinet may be either the built in or the plain wall type and with or without lighting fixtures

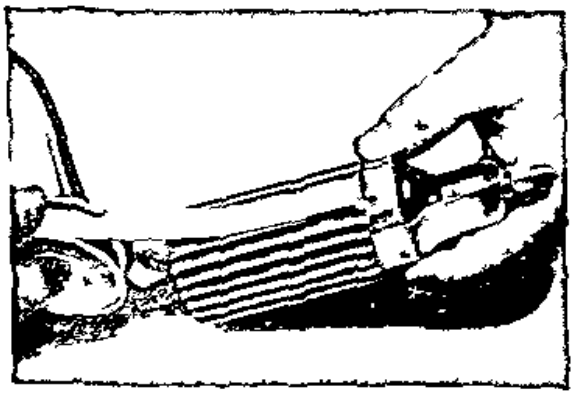
Humidifier Moistens Air and Reduces Dust from Hot-Air Furnace

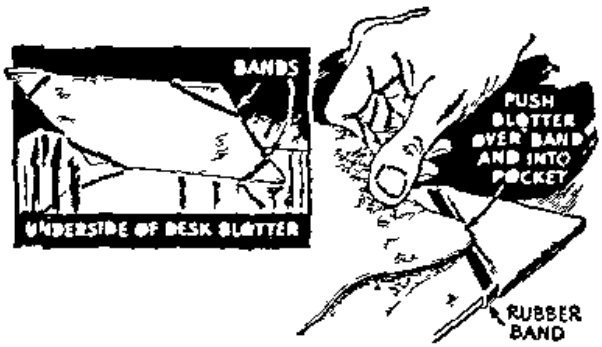


MANY homes with warm air furnaces suffer from a lack of moisture and get plenty of dust from shaking the ashes especially when there is a cold air inlet or return equipped with a slide to vary the amount of cold air taken in off the floor When this slide is open ash dust can circulate throughout the house To stop this I made a humidifier as shown with an absorbent and porus cloth screen It has been very successful and evaporates over 2 gal. of water in twenty four hours The tank is filled each day When the cloth cover becomes dirty it is thoroughly rinsed under a faucet.—ARTHUR STROHM

Corrugated Cardboard Gives Cool Grip to Hand Grinder

INEXPENSIVE hand motor grinders are usually not equipped with forced ventilation and therefore become hot when used continuously A cool grip can be added by taping corrugated cardboard around the handle



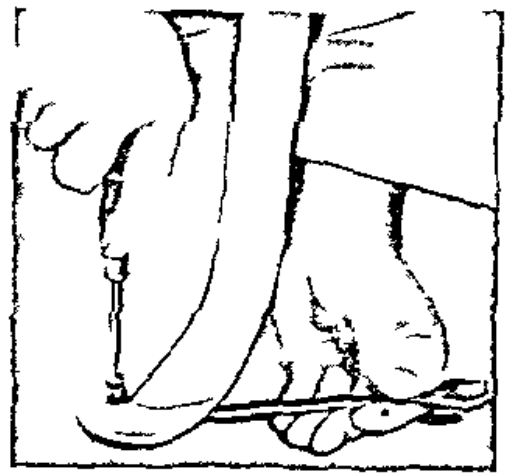


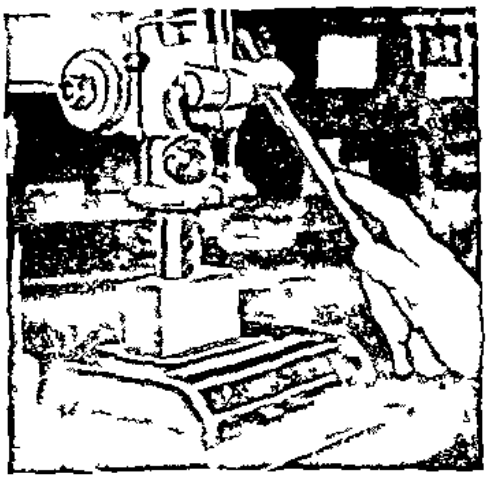
Nonslipping Desk Blotter

A HEAVY rubber band placed across each corner of a desk blotter will keep it from slipping on a smooth desk top To install the bands remove the blotter from its backing and snap an elastic across each corner then slip the blotter back into the corner pockets The bands are covered by the blotter on the top and are exposed only on the underside —CARL L. SAWYER.

Metal Machinery Stand Adjusted to Suit Uneven Shop Floor

METAL stands for woodworking machinery that have legs of the type shown can easily be adjusted to rest solidly on uneven concrete floors A short ¼ diameter roundhead bolt is inserted in the hole of the offending leg and screwed into a nut on the underside of the foot far enough to make the stand rest firmly on the floor The upper nut is then tightened to lock the bolt in place Sometimes it is wise to place a small square of sheet metal beneath the bolt particularly if the wood floor is soft or the concrete crumbly This method of adjustment insures a steady bench

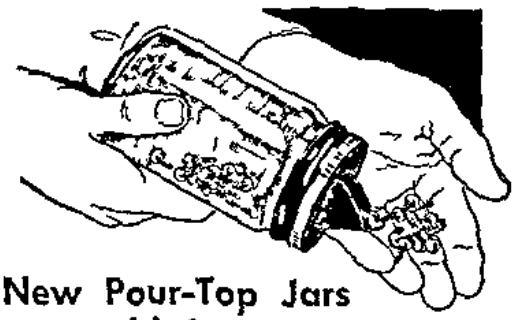




Small Printing Matrices Made on a Drill Press

OWNERS of small printing presses who also have access to a workshop drill press can use the latter to make matrices or mats of type or cuts Place the form containing the type on the drill press table Wet a piece of mat stock and lay it over the type followed by a pad of rubber (cut from an old inner tube) and a wooden block Center the block and type beneath the chuck and feed the spindle down with considerable pressure

If the first application of pressure does not make an even clean cut impression the mat can be slipped back in position over the type and the operation repeated a second or even a third time —VERNON B CASE

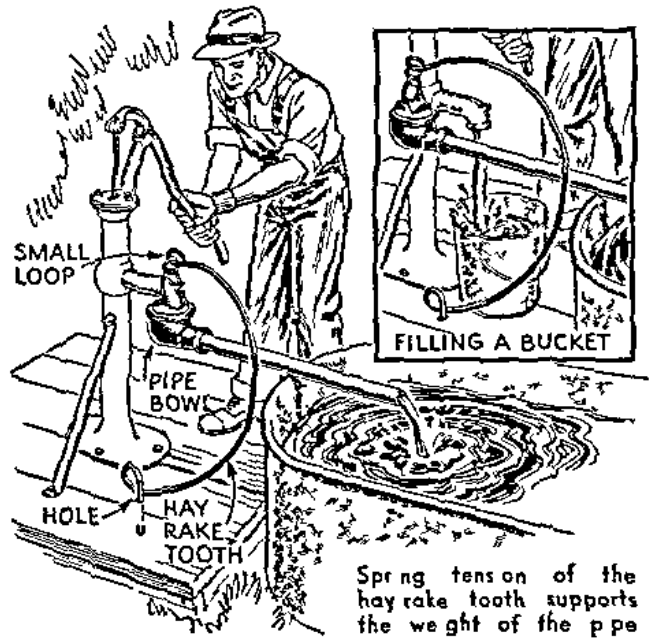


New Pour-Top Jars Hold Screws and Nuts

IF YOU are able to lay your hands on empty glass jar containers of the new type that are equipped with pour top covers you can use them to advantage for holding a selection of nuts screws and other small shop materials The large spout works like those commonly found on boxes in which table salt is sold The covers screw on the jars

Tooth from Hay Rake Holds Pipe Under Hand Pump on Farm

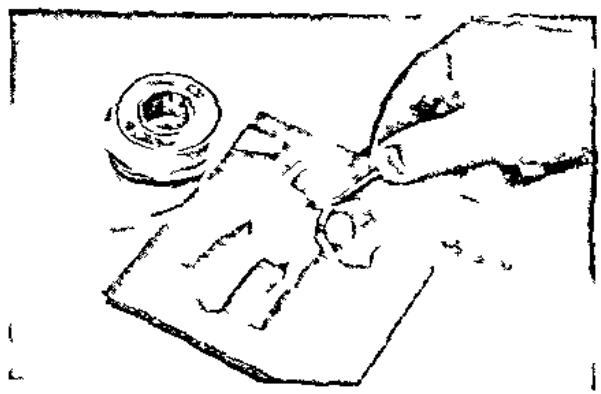
TO HOLD the tank supply pipe under a pump spout in such a way that it can be instantly attached or released a discarded spring tooth from a hay rake may be used as shown Bend a loop in the end so that it will engage the bail of the pipe bowl Anneal the end if necessary to do this Then drill a hole through the pump platform to receive the opposite end of the tooth



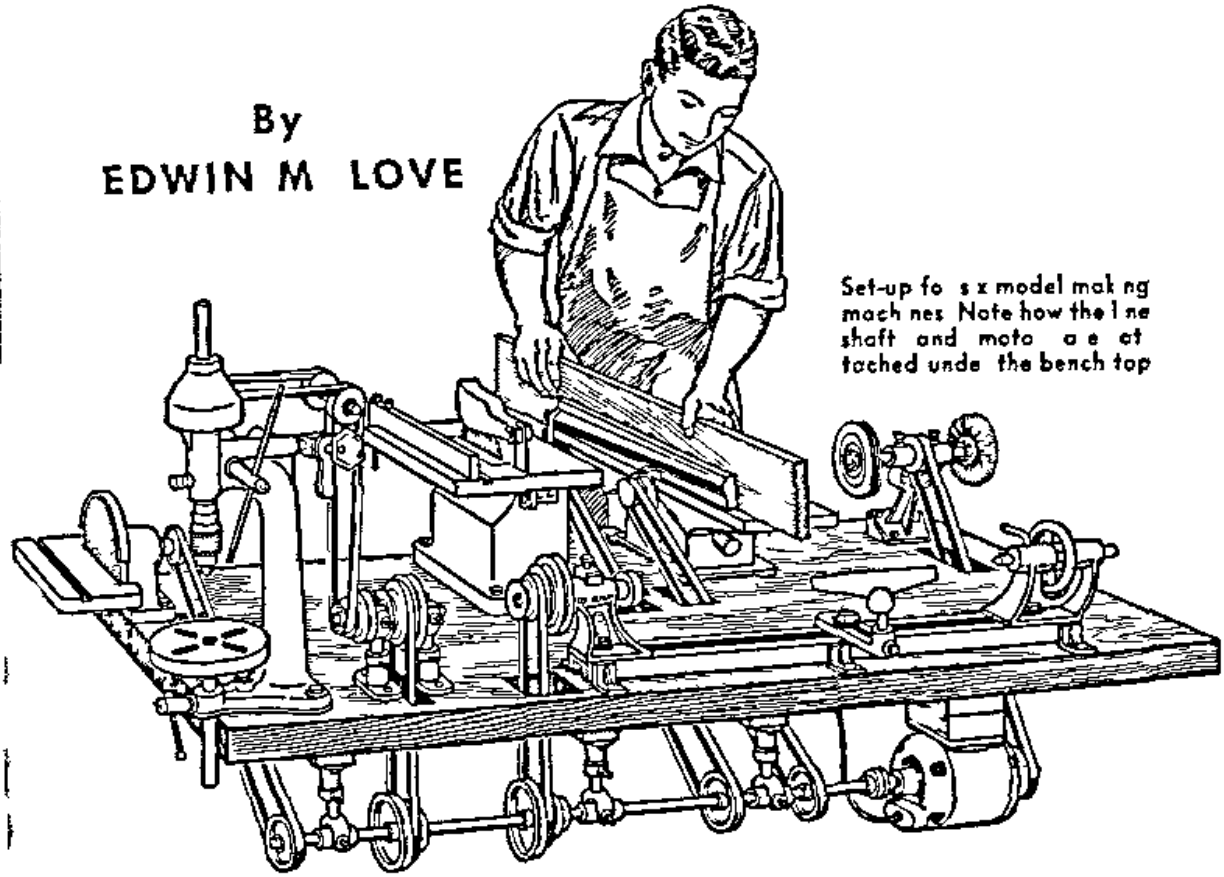
Spring tension of the hay rake tooth supports the weight of the pipe

Adhesive-Tape Strips Strengthen Weak Sections of Stencils

WHEN you purchase a new paper stencil inspect it carefully for narrow ties These have a tendency to break and fall out so cut strips of adhesive tape of the correct width and reenforce them as shown This helps to make the stencil last indefinitely



By
EDWIN M LOVE



Set-up fo s x model mak ng mach nes Note how the l ne shaft and moto a e at tached unde the bench top

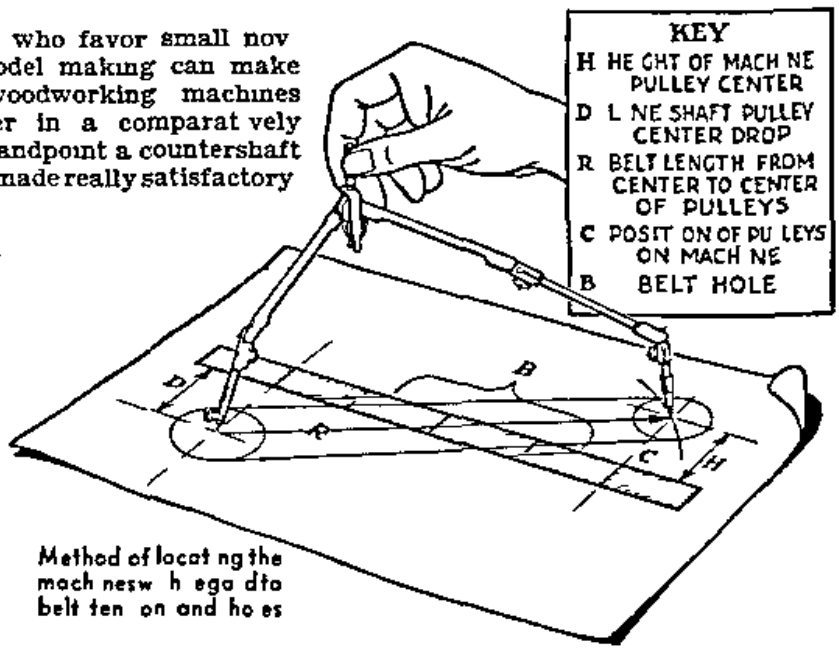
Workshop Layouts

FOR SMALL WORK and MODEL MAKING

AMATEUR craftsmen who favor small nov elty work or model making can make use of l ght woodworking machines grouped together in a comparat vely small space From the r standpoint a countershaft and line shaft drive can be made really satisfactory

No matter how small the projects themselves may be and how much of the work is done by hand, it is always more conven ient and econom cal to use machines in cutt ng stand ard stock to the smaller s zes requ red Plans for shop equipment should keep this in view

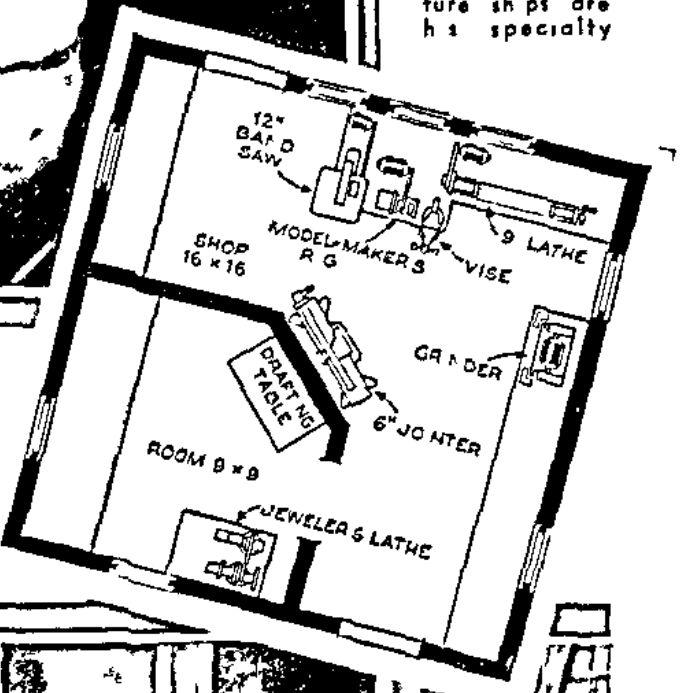
Light machines driven from one or perhaps two motors perform well on platforms or single



Method of locat ng the mach nesw h ega dto belt ten on and ho es



Charles M Allan Alhambra Calif does detail work and drafting in a small room partitioned off from his shop Below how the machines for model making are arranged and at bottom Mr Allan at work in his shop Miniature ships are his specialty

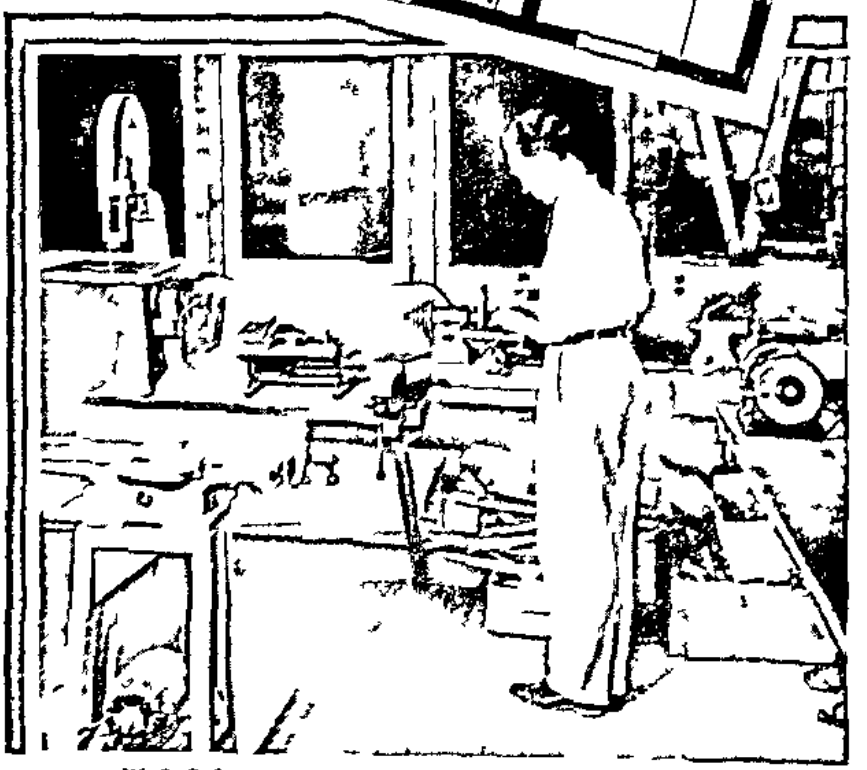


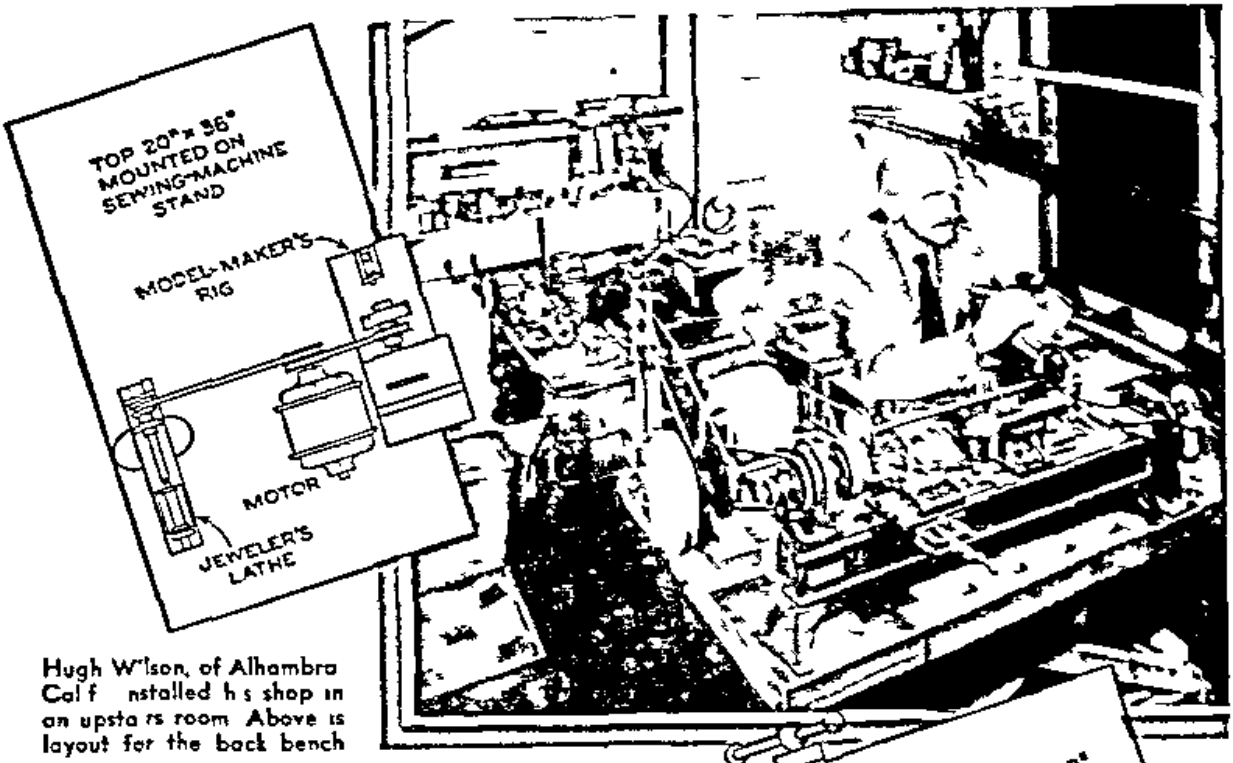
benches and where a line shaft is used it can often be put beneath the bench top thus compressing the layout and saving floor space

What is a good way to hang a line shaft under the bench top?

The drawing at the beginning of this article shows a handy grouping of six machines The shaft is below the lathe Belt tension is adjusted by the hangers if of the adjustable type or by shimming their bases if they have plain solid columns

The first thing to do is to set the machines roughly in place Arrange them so that long boards can be passed over the lathe from either saw or jointer and so that wide panels will clear the tops of adjacent machines The drill press table rises far enough to let long work clear the sanding disk table and the latter being





Hugh Wilson, of Alhambra Calif., installed his shop in an upstairs room. Above is layout for the back bench

used only for short material, has plenty of working room.

Now check the belt lengths by looping them over their pulleys and noting the distance from center to center. Mark these values down for later use. Slip the pulleys and hangers on the line shaft, and bolt the hangers to a line. Adjust the end ones so that the shaft turns freely, and then the center one.

As the motor itself has a pulley for driving the polishing head, locate the motor to suit and shim it away from the bench top with wooden blocks. If accurately placed, the motor can be attached to the shaft with a solid coupling but a flexible coupling is better because it will take care of slight irregularities. The motor must be capable of running in a hanging position.

The location of the machines with regard to belt tension, as well as the position of the holes where the belts pass through the bench top, are plotted as shown in an accompanying sketch. Draw on paper a section of the bench top to any convenient scale; it does not have to be full size. Mark the center of the line shaft (distance *d*) and draw a horizontal line marking the height of the machine pulley (*h*). Set a compass to an arc equaling (to the same scale) the experimental belt length obtained before. Center the compass on the line shaft and strike an arc through the machine-pulley height line.

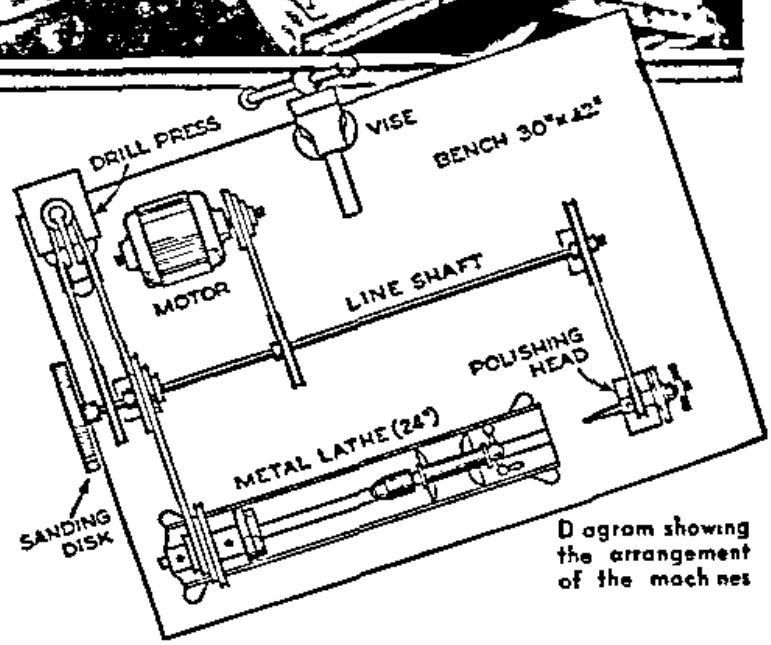


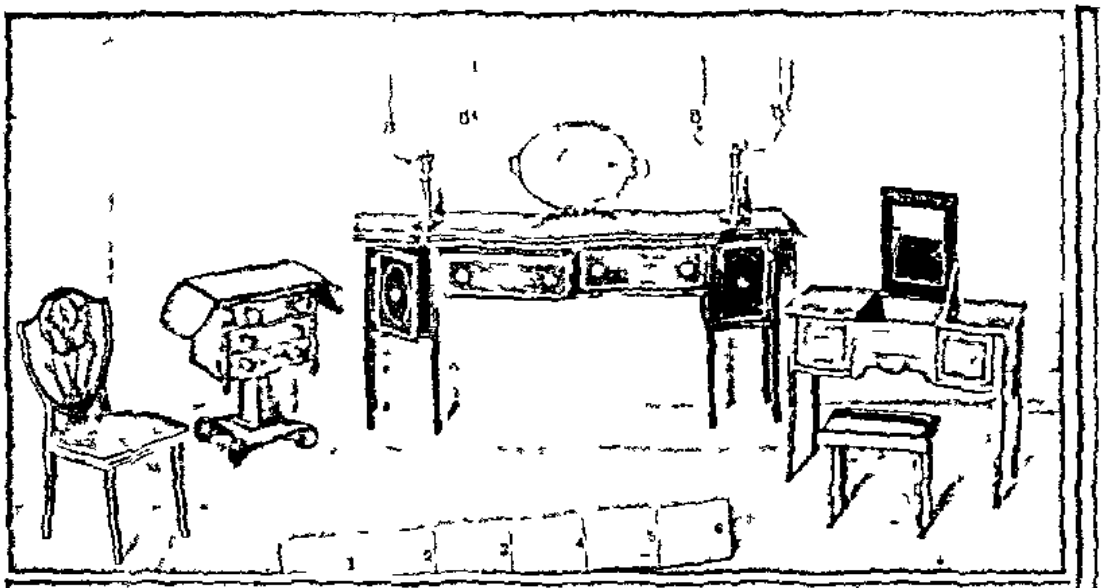
Diagram showing the arrangement of the machines

Draw circles to the same scale to represent the size of the pulleys. Connect them with lines indicating the belt. The position of the hole through the bench is then easily scaled.

When the machines have finally been set in their permanent places, align and tighten the pulleys on the shaft.

Cut a hole under the saw and another under the jointer through which sawdust and shavings can drop. Place a box or, still better, a deep drawer beneath to catch the litter. If the bench is closed in, provide a removable panel or drop door on the countershaft side.

As all belts except the one in use are removed from the machine pulleys, it is well to insert hooks or pegs in the bench top to keep the belts from slipping through the holes.



Model furniture constructed by Mr Wilson Every little detail is complete The drawers slide in and out and the doors open on scale hinges Note the 6" ruler in the foreground

How should a shop be laid out for model making?

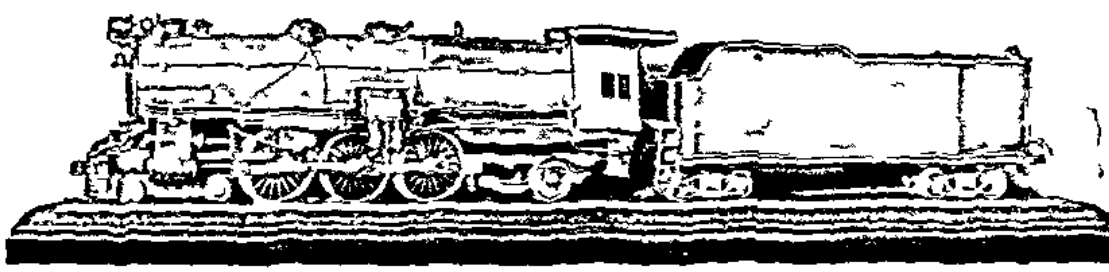
That is so much an individual matter it is hard to give definite rules Perhaps the best answer is to show two typical shops of experienced model makers

One shop illustrated is that of Charles M Allan, of Alhambra, Calif , who started in 1927 as an amateur by building a Spanish galleon model from plans published in POPULAR SCIENCE MONTHLY Mr Allan has graduated into a professional whose products are marvels of craftsmanship and sell for high figures He has provided yacht models for such notables as George Converse, Preston Sturges the movie playwright, Donald Douglas, of the Douglas Aircraft Co , and Jascha Heifetz, eminent violinist. Lincoln Ellsworth, the explorer, ordered a miniature of his famous plane, *Polar Star* Mr Allan also drew plans for many ship sets in the motion pictures ' Barbary Coast," ' Hurricane, ' and ' Dodsworth."

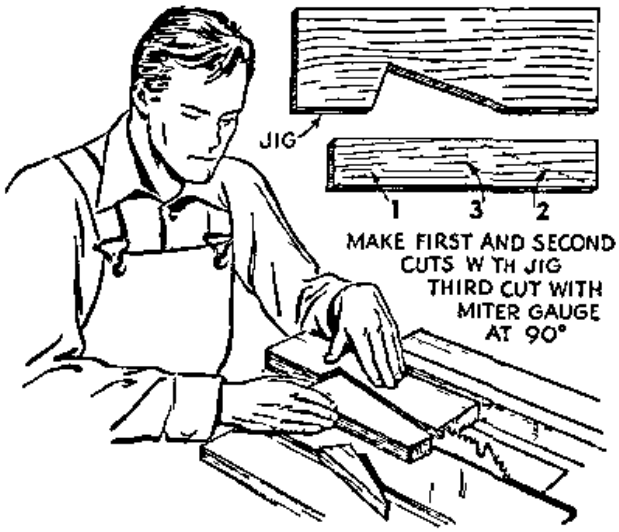
As you will see from the plan of his shop, he uses plenty of bench and window space Along the west wall he groups his band saw, lathe, vise, and model-maker's rig, but the latter, being portable, is usually found near the work at hand Drafting and small detail work are done in a room partitioned off from the shop, where there is a small bench with a jeweler s lathe and soldering equipment

Hugh Wilson, another professional model maker of Alhambra, does most of his work in a bedroom. Although a ship-model expert, he now majors in HO locomotives and miniature furniture His expert craftsmanship and wide experience make the layout illustrated in the drawing well worth studying For reducing large stock to usable size, he has in his garage a band saw, circular saw, and jointer

For many of the layouts described in this article and the preceding one a motor with a reversing switch is required, otherwise the belts on some machines must be crossed.

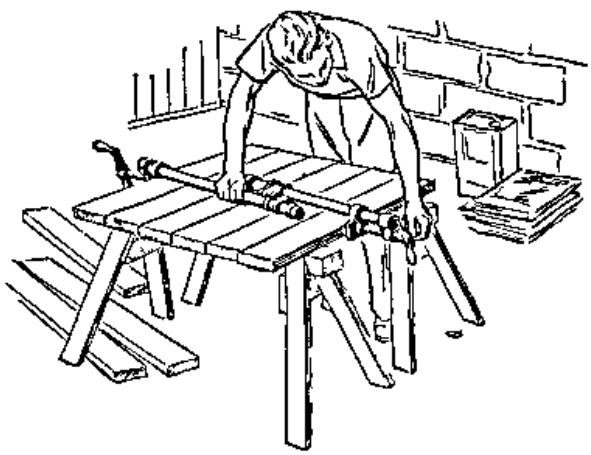


Mr Wilson's interests cover many phases of the model making field. Here is a locomotive he built



Identical Wooden Wedges Cut on the Circular Saw

TO CUT any number of identical wedges quickly on a circular saw make a jig out of scrap lumber as shown The stock from which wedges are to be cut is placed in the jig and the whole pushed along the ripping fence which is adjusted so that the blade just clears the jig Waste can be eliminated by using precut pieces the width of the wedges but twice their length In this case the final cut must be made with a miter gauge set to 90 deg —H. WALTON



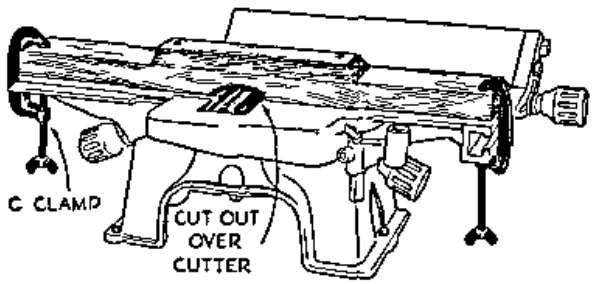
Two Short Clamps Combined to Form a Long One

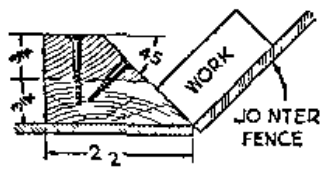
USERS of standard clamp attachments of the type made to fit on lengths of pipe can convert two short clamps into a long one by joining them in the manner illustrated It is necessary only to give the sliding jaws which are free to revolve on the pipes a quarter turn in order to butt them together alongside the work

Auxiliary Fence on Jointer Forms Chamfering Trough

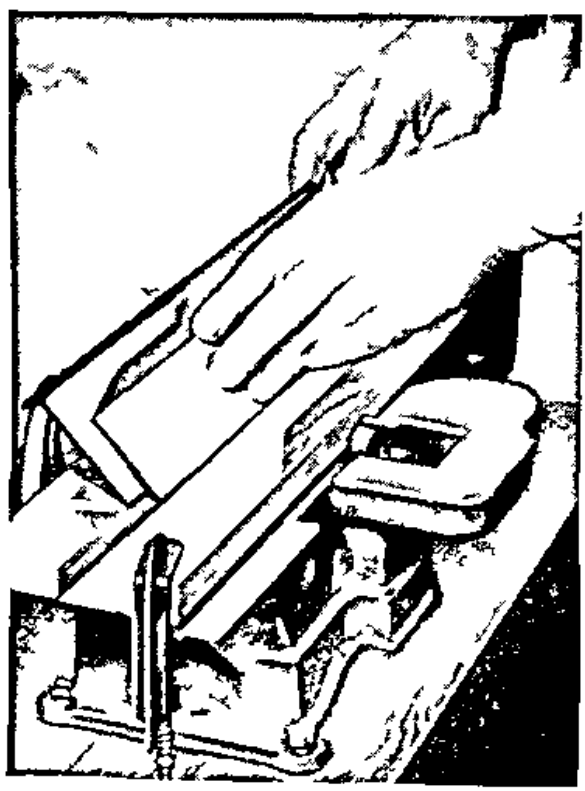
CHAMFERS of any size can be cut accurately and safely even on a small jointer if a 45 deg wooden fence is added as shown below so as to form a guide trough The work sinks down until supported by both fences It is therefore impossible to cut too deep all cuts are the same size and stop chamfers of any length can be made because the work is supported by both sides instead of merely the uncut corners as is the usual practice

The work can be turned end for end and the cut can be started at each end of a stop chamfer thus insuring clean cuts at both ends Even the ends of narrow boards can be chamfered —JOSEPH WILLIAMS

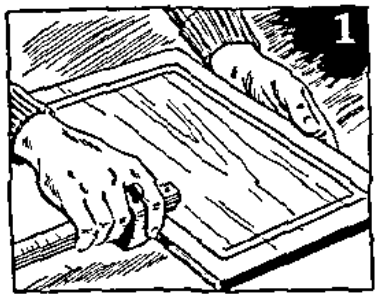


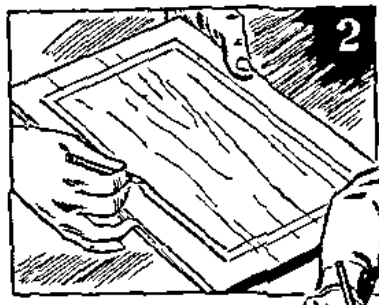


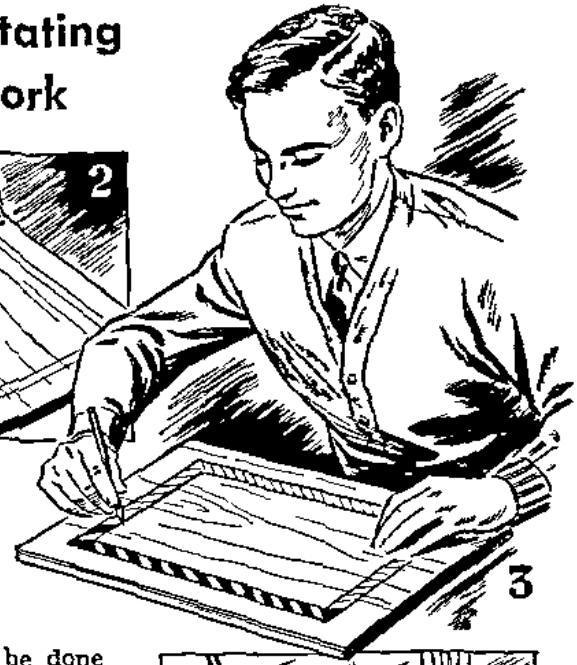
Above the fence in place Left how work s held Below fence in use



Colored Pencils Used for Imitating Inlaid Borders on Woodwork



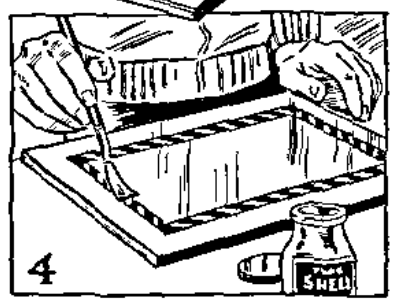




AN INEXPENSIVE process which uses colored pencils to produce the effect of inlaid borders on furniture and other wood work is meeting with success in the Boys Club and three public schools of Pittsfield Mass It has been especially popular in the schools since the drawing and color work can be done partly, at least in art classes It was introduced by Walfrid T Victoreen manual training instructor The steps are as follows

1 Mark outlines of border with a marking gauge 2 Pencil the grooves to make the lines distinct 3 Trace the chosen design (peppermint stick stripes are simplest) in light pencil marks and fill in uniformly with colors If mistakes are made they can easily be corrected Simply sandpaper the surface and start all over again 4 Finish the entire surface with several coats of shellac and rub down with fine steel wool between coats

This process can be used on stands tables utility boxes *book racks book ends smoking and sewing stands and* many other pieces of furniture or craftwork novelties



Four steps in decorating a small panel for a furniture project Because of its simplicity the method is very popular with boys

WHITE PINE [WOODWORKING]

Color—Heartwood, cream to light reddish brown, sapwood, white to pale ivory

Properties—Soft, lightweight, and quite strong, close, fine, straight grain, compact, even texture, shrinks moderately, easily worked and nailed, durable outdoors

Paint—Takes paint very well Priming coat should be rich in turpentine and linseed oil second and third coats less so Paint on sappy spots should be allowed plenty of time for drying

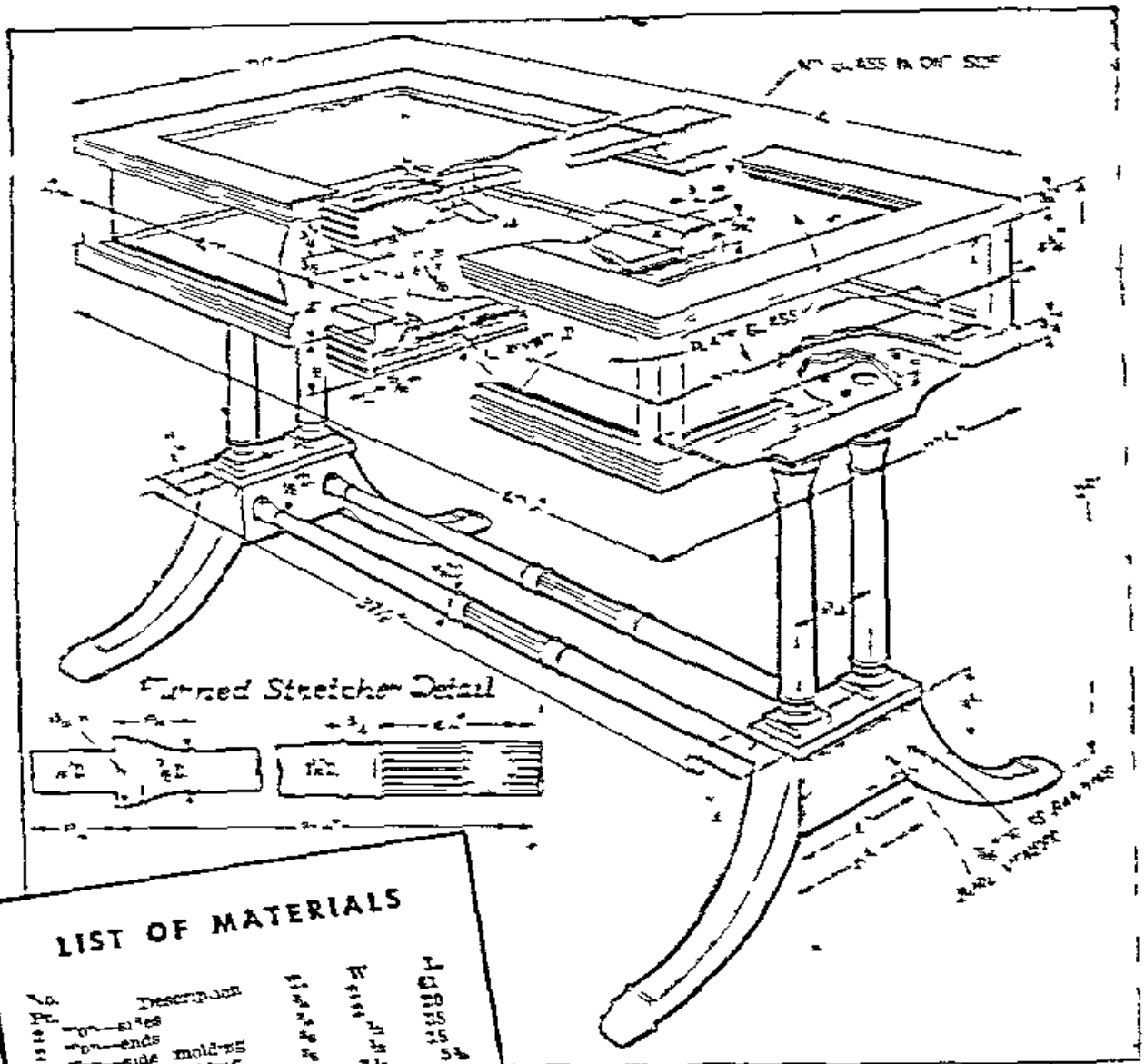
Stain—Takes water or oil stains readily to give good browns. Filler is optional

Uses—Furniture boats, building materials, foundry patterns, boxes, and musical instruments

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Designed by
DONALD A.
PRICE

HOBBY TABLE



LIST OF MATERIALS

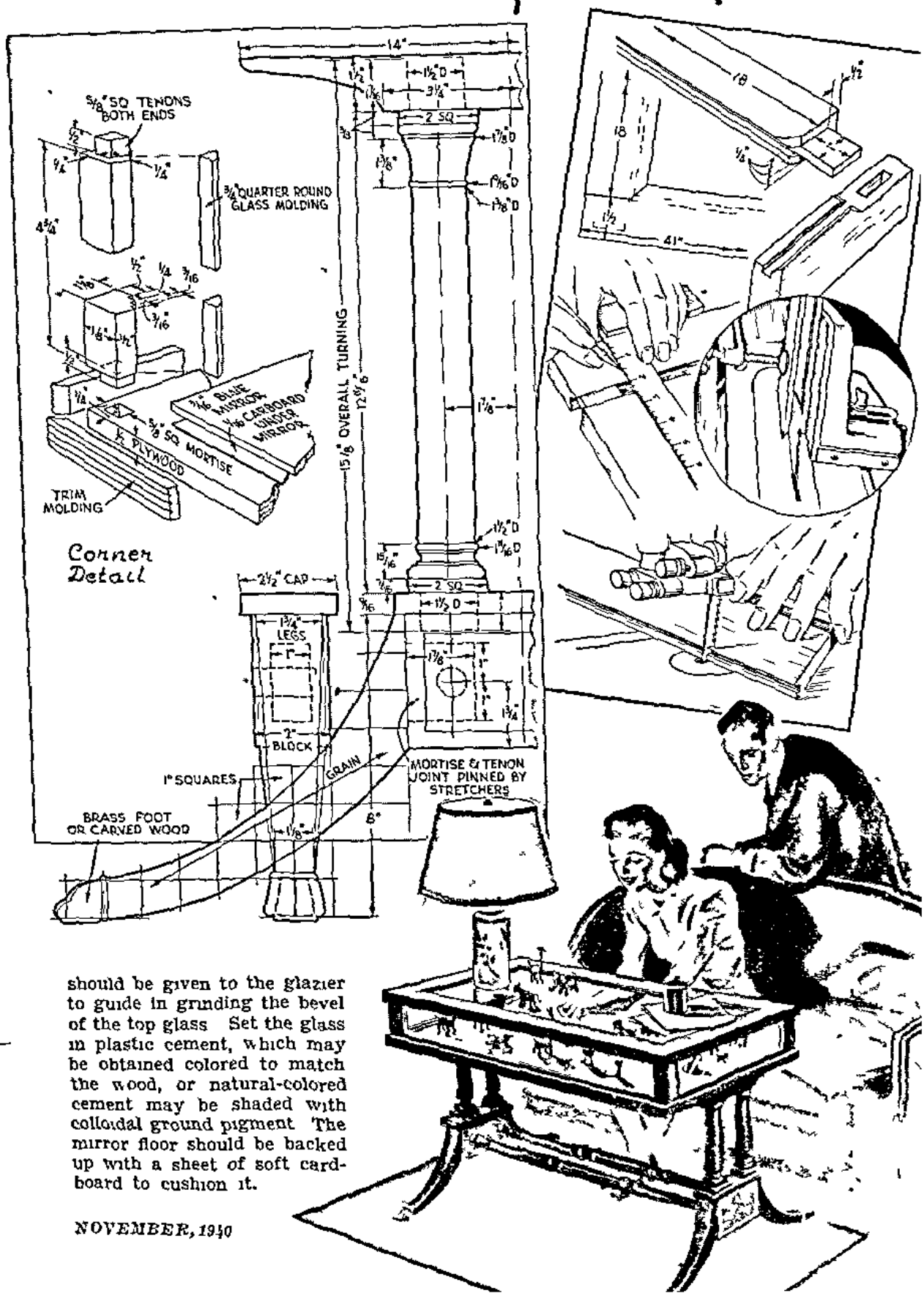
No.	Description	W	L
Pc.	Top—sides		
Pc.	Top—ends		
Pc.	Top—side moldings		
Pc.	Top—end moldings		
Pc.	Corner posts		
Pc.	Base stop—front		
Pc.	Base stop—rear		
Pc.	Base stop—ends		
Pc.	Head stop—front		
Pc.	Head stop—rear		
Pc.	Head stop—ends		
Pc.	Quarter round—sides		
Pc.	Quarter round—ends		
Pc.	Lower mol ngs—sides		
Pc.	Lower mold ngs—ends		
Pc.	Floor—birch		
Pc.	Cleat brackets		
Pc.	Legs		
Pc.	Feet block cap		
Pc.	Feet block		
Pc.	Feet		
Pc.	Stretchers		

Note: All dimensions are given in inches.

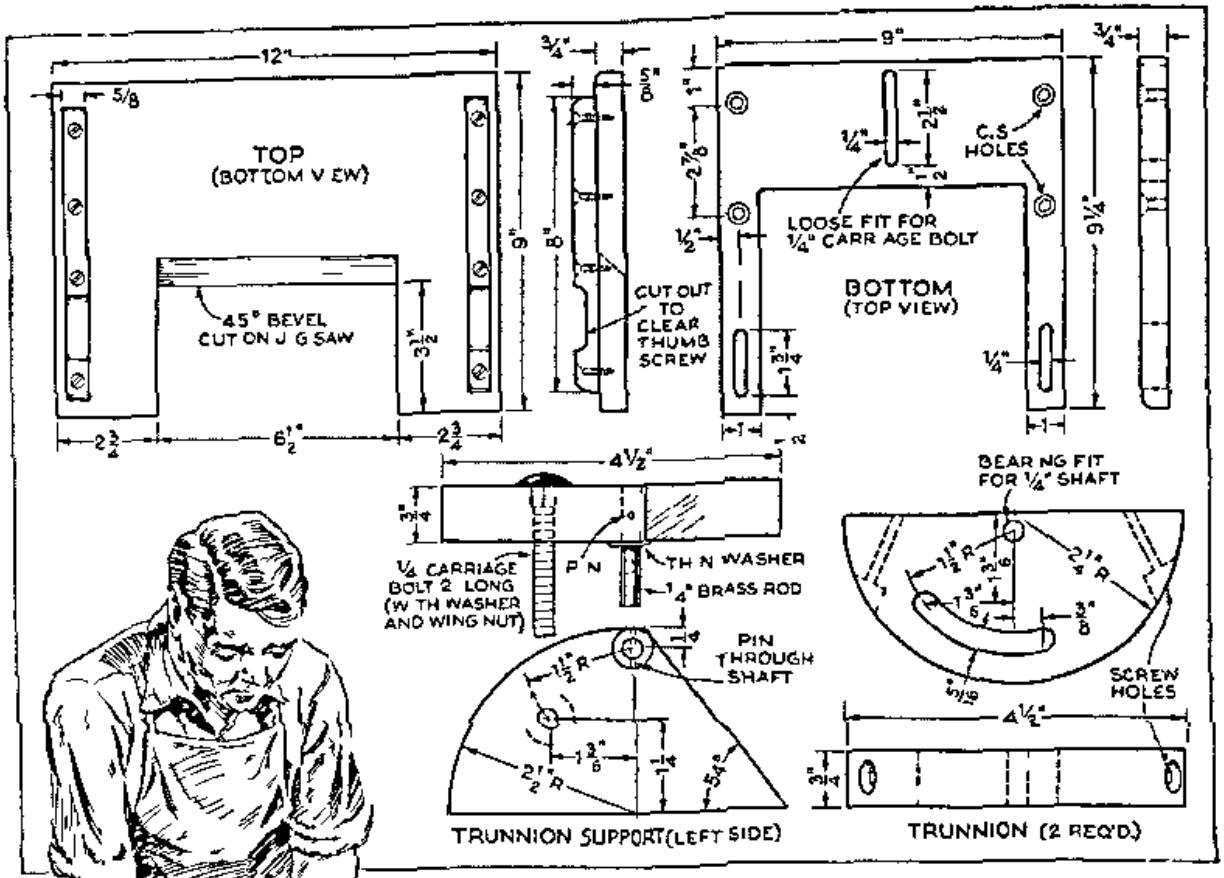
THIS hobby table is designed for displaying small craftwork articles, models, and collections. It is modeled after a Duncan Phyfe mahogany drop-leaf table in the Metropolitan Museum of Art, New York. The top and three sides are of plate glass. One side is left open for access to the interior, but it can be closed with sliding doors if desired. The floor is covered with a blue or rose glass mirror.

The following plate glass ¼" thick is required: 1 pc. 17¾" by 37¾" for the top, 1 pc. 4⅜" by 35" for the side, and 2 pc. 4⅜" by 15" for the ends. The mirror floor is 3/16" by 15" by 35". The top frame

in Duncan Phyfe Style



should be given to the glazier to guide in grinding the bevel of the top glass Set the glass in plastic cement, which may be obtained colored to match the wood, or natural-colored cement may be shaded with colloidal ground pigment The mirror floor should be backed up with a sheet of soft cardboard to cushion it.



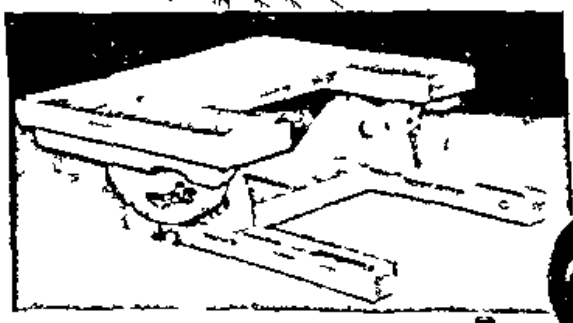
Wooden Disk-Sander Table Can Be Used with Any Small Shop Motor

ALMOST any small motor can be used as a disk sander with the addition of the wooden sander table illustrated It is easy to build and adjust, accurate, tilts to a full 45 deg, and can be detached quickly when the motor is required for other uses

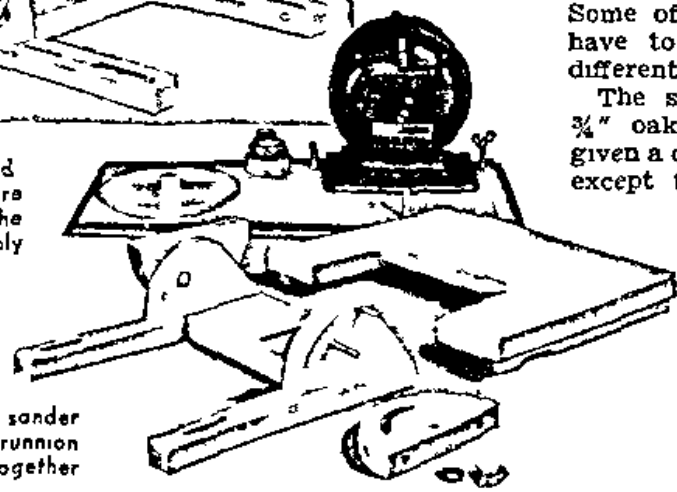
The drawings give dimensions for a table to suit a 6" sanding disk and a motor that is ordinarily used to drive a polishing head Some of the dimensions may have to be altered to fit a different type of motor.

The stock is well seasoned ¾" oak The assembly was given a coat of aluminum paint except the top of the table, which was finished with two coats of spar varnish, waxed, and polished

Should you care to improve the design still further, the top might be grooved and a miter gauge fitted to it.—R. E MATHIAS



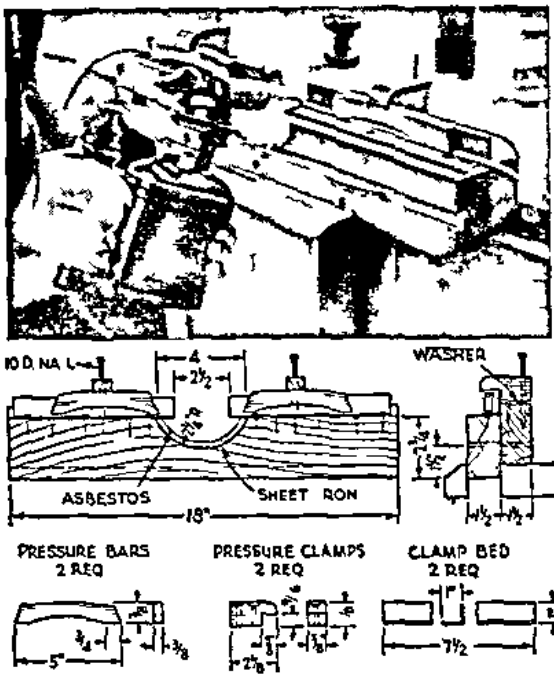
A protractor and adjustable square were used to lay out the scale after assembly



The parts of the sander table with one trunnion and support put together

Easily Improvised Clamp Holds Band Saw for Brazing

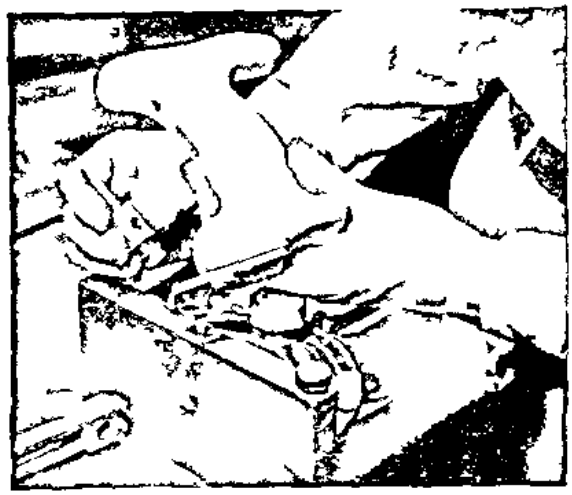
THE inconvenience and delay of sending a broken band saw blade away for brazing may be avoided by making a clamp as shown below and doing the brazing yourself Line the circle in the center of the block with sheet iron and asbestos paper to protect the wood The brazing is done in the usual way except that with a home made clamp of this type it is necessary to wind the joint tightly with fine soft iron wire and push a small brad under the top wires to hold the tapered ends in contact.



The center of the block s l ned w th sheet ron and asbestos paper to protect the wood f om heat

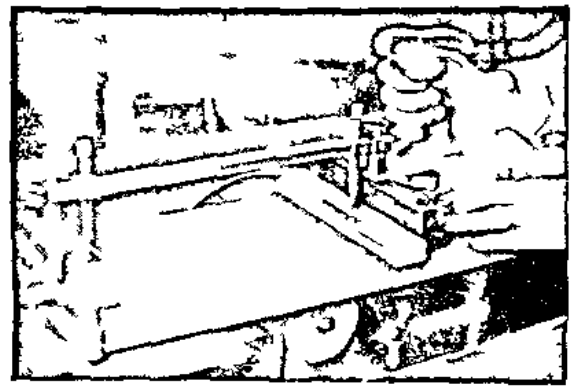
How to Clean Rasps and Wood Files

CLOGGED teeth of rasps and wood files can be cleaned by pouring alcohol over them sett ng it alight and then brushing off the charred particles of wood with a file card.



Miter Gauge of Circular Saw Improved by Adding Handle

THE miter gauge of a circular saw is eas er to use if provided with a comfortable handle Trace the outline of a handsaw handle on a piece of 1 oak or other suitable wood and leave some extra wood at the bottom Shape the handle with band saw rasp and sandpaper The exact method of mounting will vary but in the case illustrated a piece of steel bar stock was cut and drilled to form a link between the wooden handle and a stud on the gauge

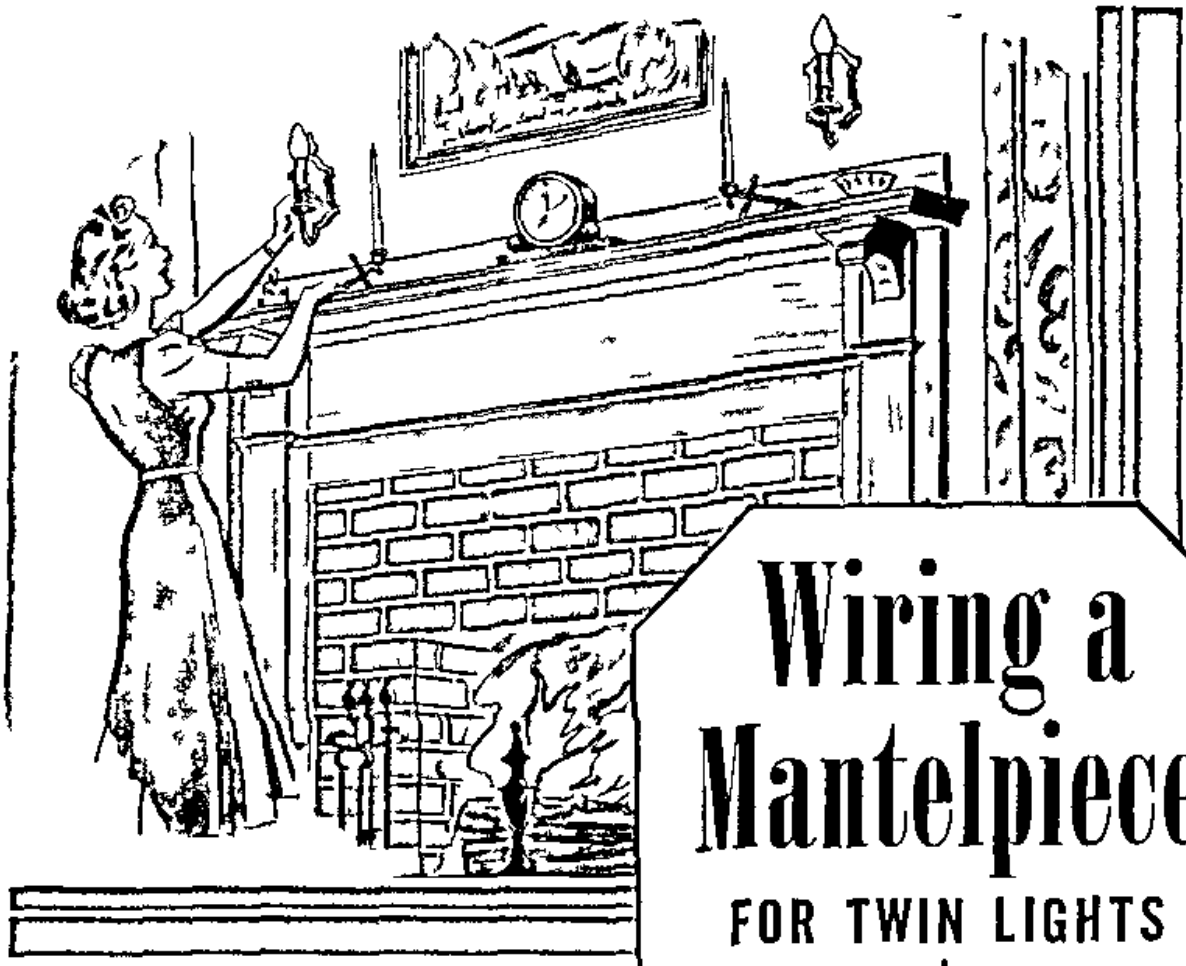


In th s case the handle s held by a steel st p d lled to rece ve the stud on top of the gauge

Ends of Auger Bits Protected by Cardboard Caps and Corks



WHEN auger bits are not carried in a bit case they can be protected as shown with short sections of medium or heavy weight mailing tube forced over corks or softwood plugs If cardboard tubing of the right size is not at hand pieces of hose or rubber tubing may be used This method protects not only the b t screw but also the cutting spurs and lips —W C W



Wiring a Mantelpiece

FOR TWIN LIGHTS and an ELECTRIC CLOCK

MODERN houses frequently have a pair of attractive wall bracket fixtures over the fireplace and an outlet in the center for an electric clock When lacking these can be installed by the method illustrated

First bore up from the cellar into the partition just to one side of the fireplace (Fig 1) A snake wire is next passed up (Fig 2) to make sure the space is open the entire way up to the mantelshelf Both ends of the snake have a hook formed with a pair of pliers The upper hook will be caught in the partition with another snake wire inserted from above At the lower end a trimmed end of BX cable is wrapped on just ahead of the hook

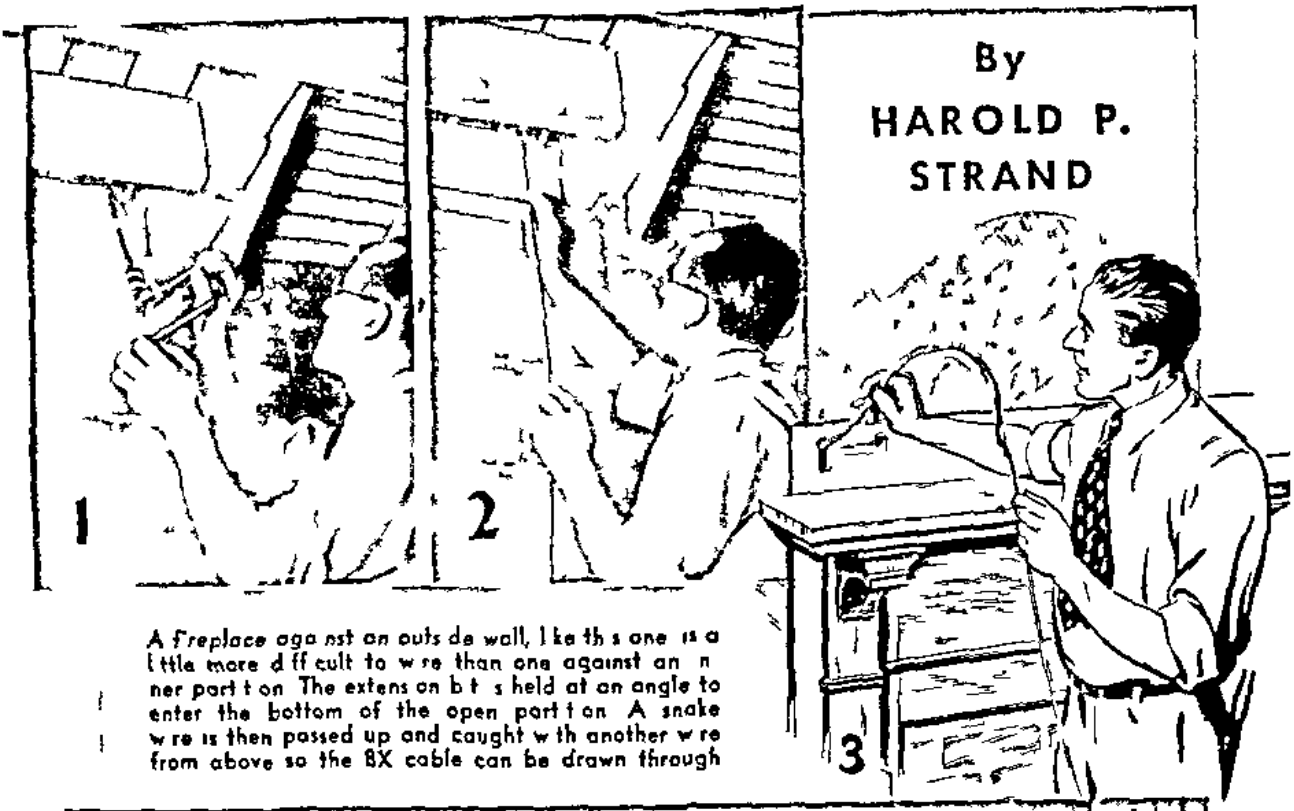
The board usually found at the back of the mantel is removed by driving in the nails with a nail set and gently prying it off A small hole is made at the extreme left (Fig 3) through lath and plaster Another hole is cut just to the right of the first stud The second snake wire is now pushed up through the latter to make sure the space is open to the point chosen for the light The hook on the original fish wire inserted from the cellar can then be caught by the hook on the end of the second snake and pulled out Continue to pull until the BX cable is out of the hole sufficiently far to reach the light outlet

The cable is now carried to openings made in the plaster and lath corresponding to the locations of the outlets From the first bracket outlet a piece is carried to the clock outlet and from there a piece runs to the right hand bracket opening Where a stud has to be crossed and no space is found at the back as was the case here a slot is made across the face of each stud capable of taking the thickness of the cable Red fiber bushings are inserted on the ends of each cable as required by the Electrical Code (Fig 4) Take care to keep all work within the space covered by the backboard

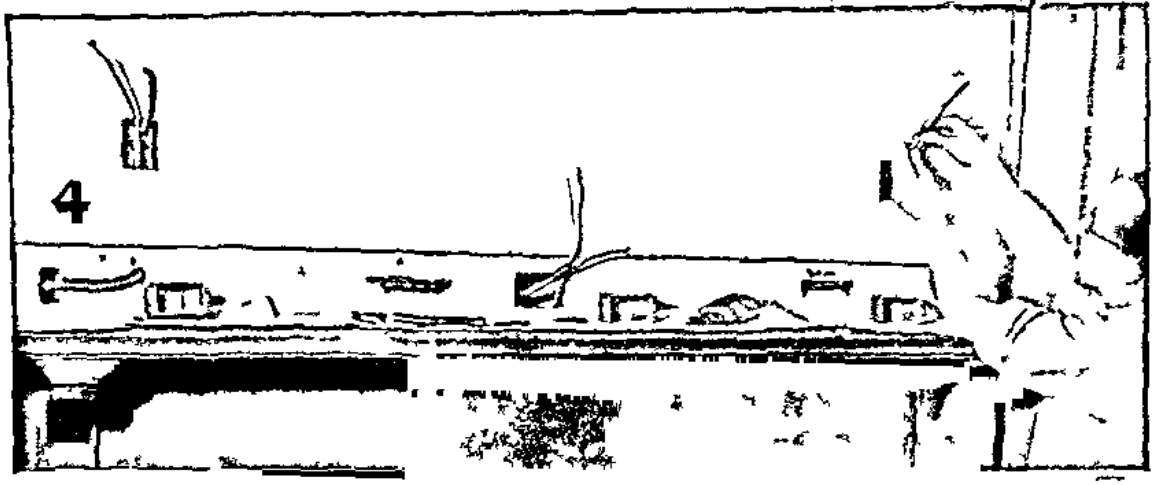
Install the two switch boxes at the bracket outlets (Fig 5) with their ears flush with the plastered surface and use 1" No 4 flathead wood screws Make sure the ends of all BX are brought into the boxes through the knock out armor

The backboard is prepared by cutting a

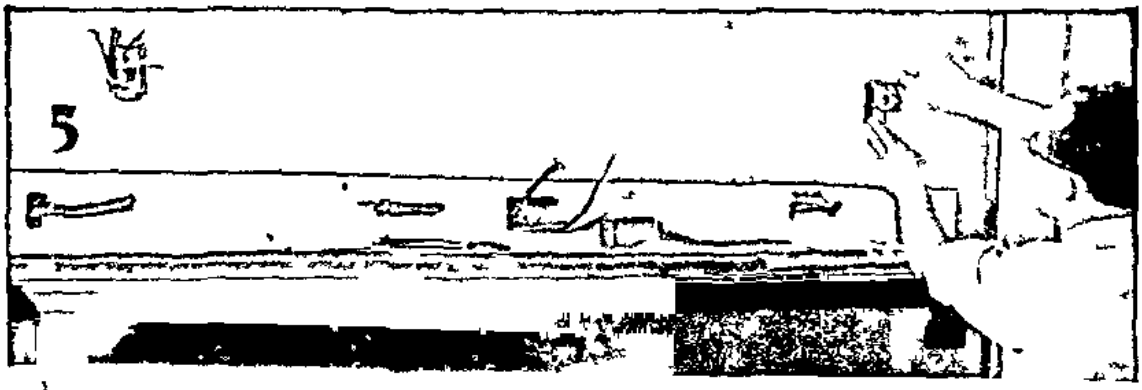
By
HAROLD P.
STRAND



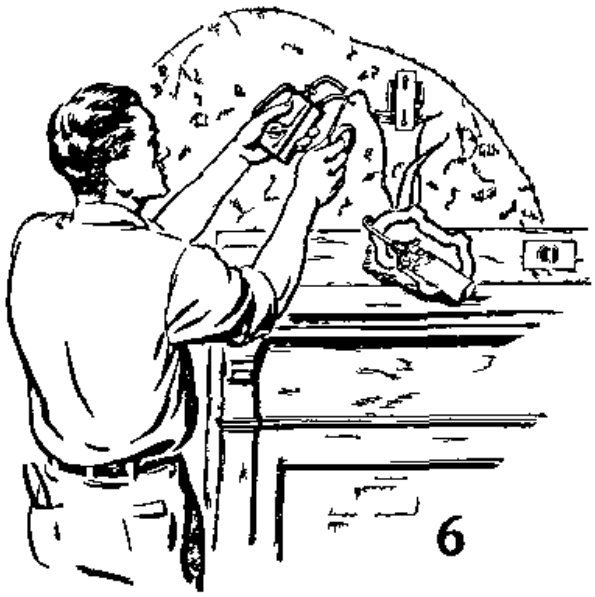
A fireplace against an outside wall, like this one is a little more difficult to wire than one against an inner partition. The extension bit is held at an angle to enter the bottom of the open partition. A snake wire is then passed up and caught with another wire from above so the BX cable can be drawn through



How the wiring is carried across in the space that is to be covered by replacing the backboard



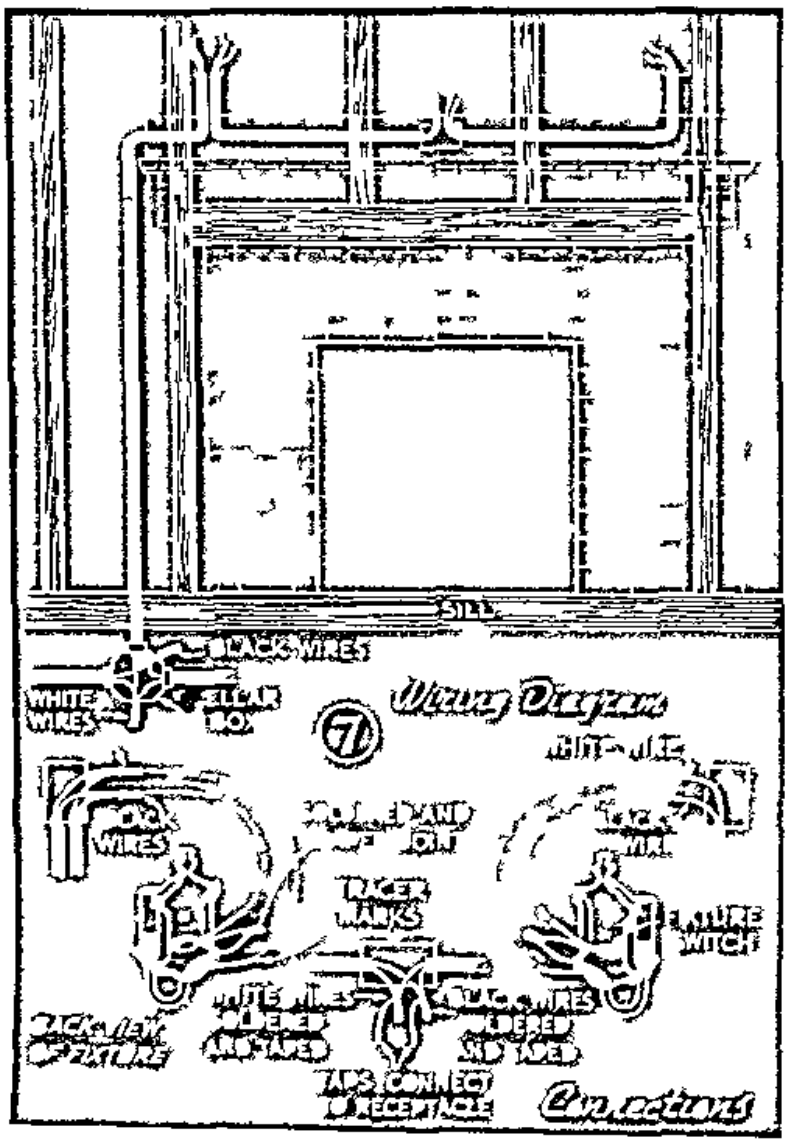
The boxes at the bracket outlets are installed with their ears flush with the plastered surface

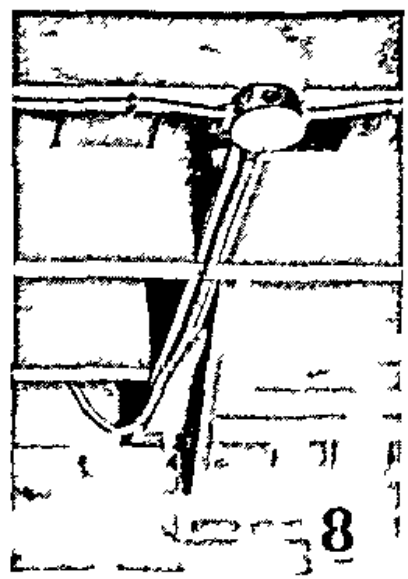


The conne on a e solde ed then the f xtu e s fa ened w h a sw tch box ba n pp e and knob

hole n the center to fit a box for the receptacle The backboard is then replaced and the box and receptacle are installed Use ½ flathead wood screws to secure the box. The r ght hand bracket n F g 6 has been connected and the left one is having ts joints soldered A sw tch box bar n pple and knob are used to secure the fixture to the wall Use both rubber and friction tapes on all jo nts The connect ons are shown in the d agrams (F g 7)

In the cellar the BX is run to a su table po nt where a connection can be made In this case a cable happened to be runn ng along the bottom of a t mber nearby feed ing a base receptacle above The staples were loosened and enough slack could be pulled back from the turns where it was qu te loose so a 3 junct on box could be cut in as shown in F g 8 In some cases it m ght be necessary to run the BX to the cellar l ght box or perhaps the meter board If the house w ring happens to be of the open knob and tube variety it might be better to subst tute nonmetallic sheathed cable for BX in w ring the mantel because this material is cons dered safer to use w th open wir ng When us ng e ther type of cable observe the Code rules call ng for a running board where t mbers are to be crossed This is first na led up to the t mbers and the cable secured to it.

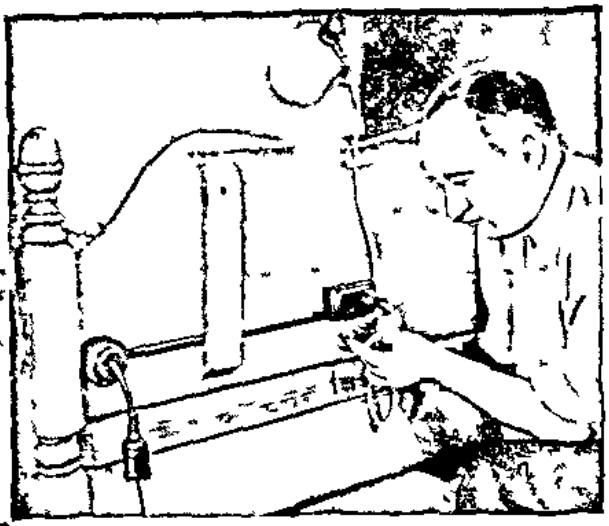




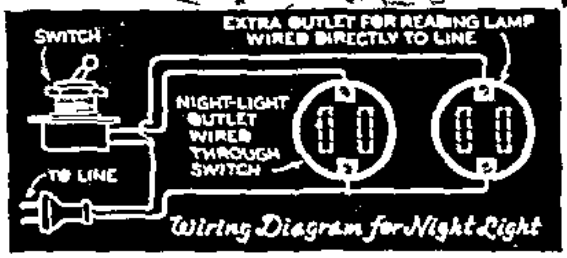
Whe e BX cable has to be ca ed ac o s f oo beams n the ce a t s necessary f rst to na l up what s called a unn ng boa d

Night Lamp Back of Bed Lights Room Faintly





How wiring is attached to the back of the head board A hole is drilled for the toggle switch



DESIGNED to give the minimum light required to see faintly around a bedroom, this night light will not disturb another person sleeping in the same room It is an invaluable aid for example in seeing if a baby has become uncovered in his crib

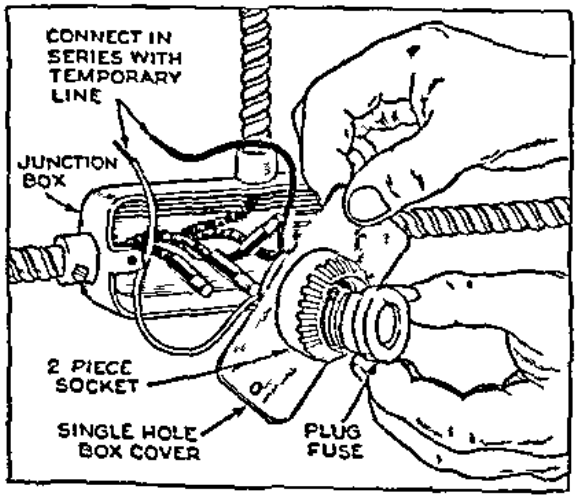
The light is from an indirect 7 watt lamp plugged into a double utility outlet behind the headboard of the bed A bed lamp is plugged into the other side of the outlet.

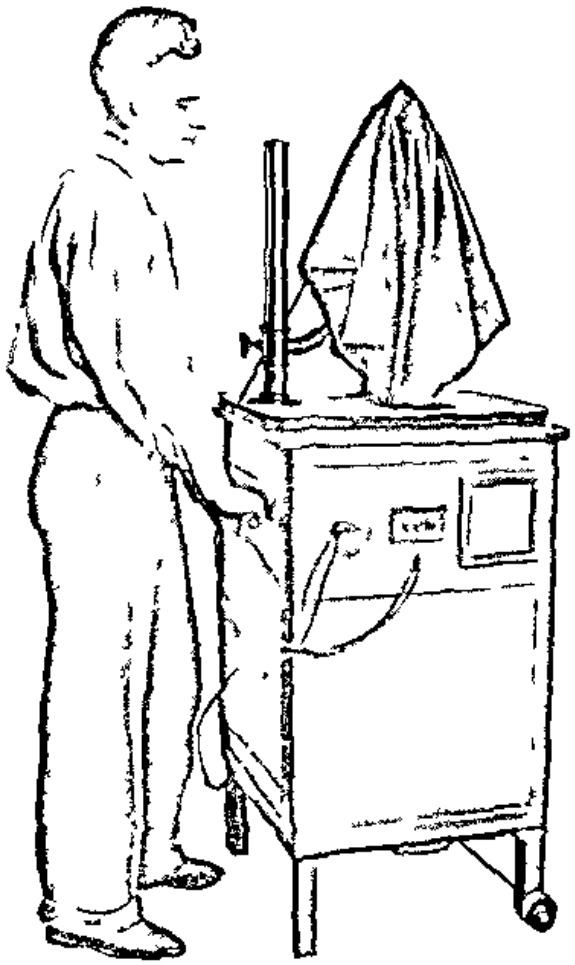
The circuit is controlled with a toggle switch, which is mounted by drilling a small hole in the headboard On the rear of this switch is a round metal box in which all the necessary connections are made and the wires spliced soldered and bound with both rubber and friction tape

Small metal molding is used to protect the wires between the switch and the double outlet The latter is changed into two separate outlets by cutting one terminal plate into two and filling the space with sealing wax One outlet is wired through the toggle switch for the night light, and the other or extra outlet is wired directly to the line as shown in the diagram so it can be used for a reading light and operated independently of the night light The wiring must be of a thoroughly protected, safe type such as would meet with the approval of the Fire Underwriters —A L. BUNZICK

Plug Fuse Serves as Switch in Temporary Circuit

WHEN a temporary electric circuit is needed both fusing and switching facilities can be provided by the method illustrated After making the desired connections in an outlet or junction box replace the cover of the box with one having a single outlet hole A blank cover can be cut out to serve this purpose, if necessary Into this, insert a two-piece porcelain lamp socket which has been wired in series with the temporary circuit. A plug fuse of suitable blow-out rating completes the job Unscrewing this fuse disconnects the circuit.—J M.





Portable

COMPLETE DARKROOM FACILITIES COMBINED IN ONE SMALL CABINET

By
J. J. WENNER

COMBINING all the necessary features of a large darkroom into one compact, portable unit, this photo 'lab' should appeal to the camera enthusiast who lives in a small apartment or is otherwise limited for space.

A place is provided for every necessary item, yet the cabinet itself is small enough to be stored in a closet or out of the way corner from which it is readily hauled into the darkened kitchen or bathroom so as to be convenient to a sink. Only one electrical connection need be made to the nearest outlet and you are ready to operate.

The pictures and drawings are intended to convey the general idea of what can be done, rather than specific instructions for building this unit. Every camera fan has his own ideas as to what equipment is most necessary and can readily alter the design to suit his own needs.

The darkroom compartment is of adequate size for loading film into a daylight developing tank, and on occasion can even be used for tray development of cut film. It should be painted with dull-black acid-resisting paint, or, lacking this, a coat of dull black paint followed by a coat of hot paraffin. The sleeves are a double thickness of light-tight black cloth, sewed to form cylinders measuring 5" by 15", provided with elastic, and glued to rings cut from ¼" plywood. These rings are then fastened to the side of the darkroom with the cloth between.

A door in front of the cabinet gives access to the darkroom and also provides a handy shelf when opened. A hook or chain holds it level. Felt weather stripping is used to assure that this door will be light-tight.

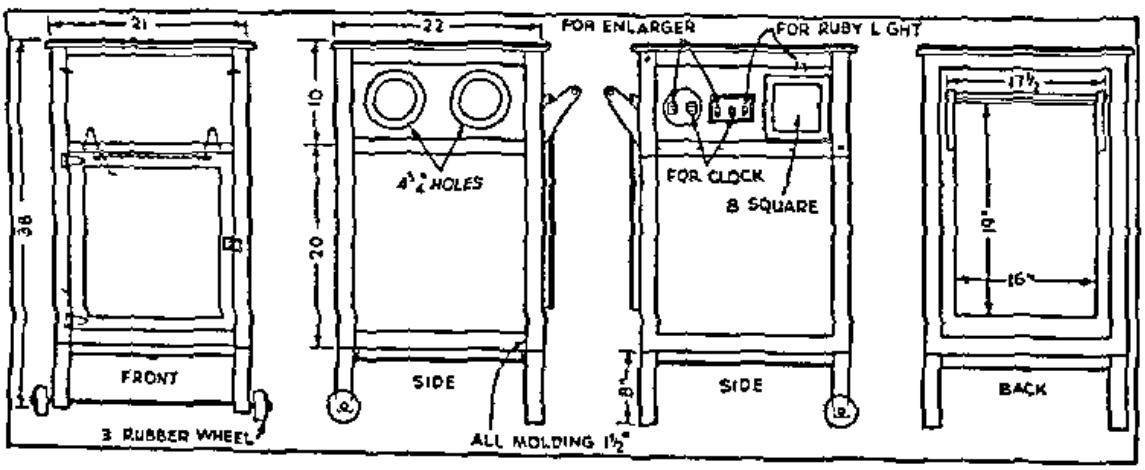


Photo "Lab"

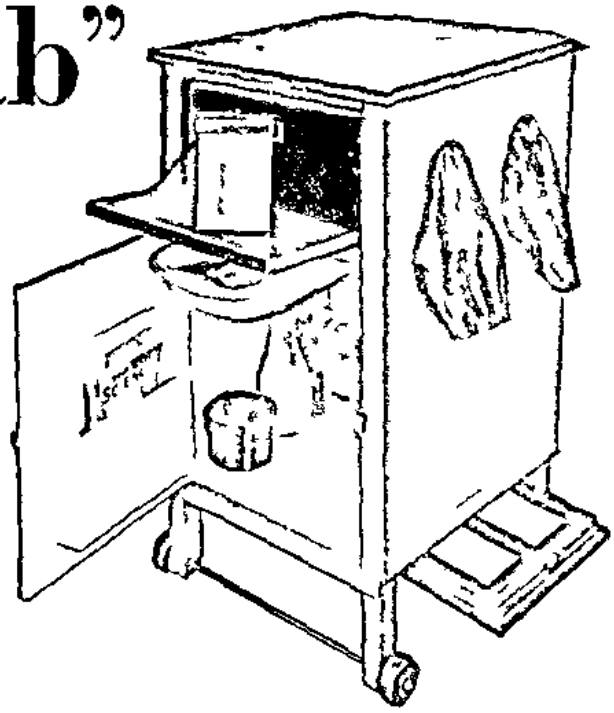
The darkroom proper does not extend the entire width of the cabinet. A ¼" plywood partition separates it from the electric service compartment The outside face of this compartment, also made from ¼" plywood is removable for working on the wiring The duplex plug triple switch and ruby light are mounted on this panel

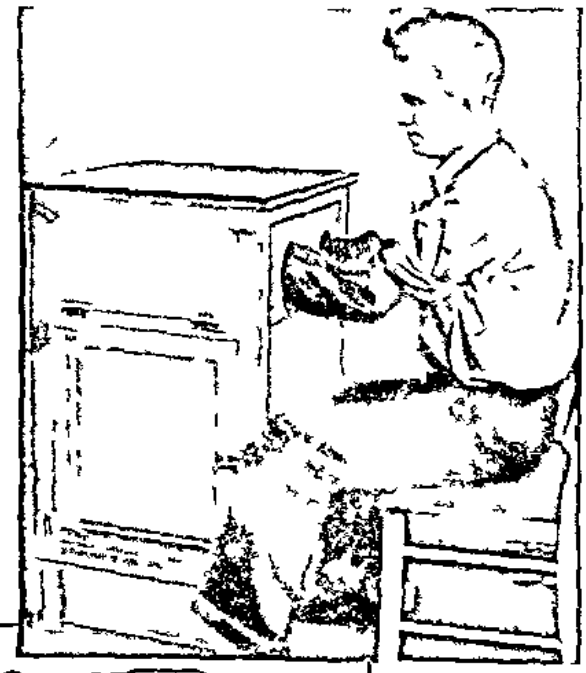
The ruby light, used when enlarging, consists of a wood frame holding two sheets of glass between which two or three sheets of orange crêpe paper have been pasted A 10 watt frosted bulb is fastened at the top of the compartment behind the window This small bulb also dimly lights up the storage compartment below through the three holes in the shelf and makes it easy to find articles in the storage compartment when working in a darkened room

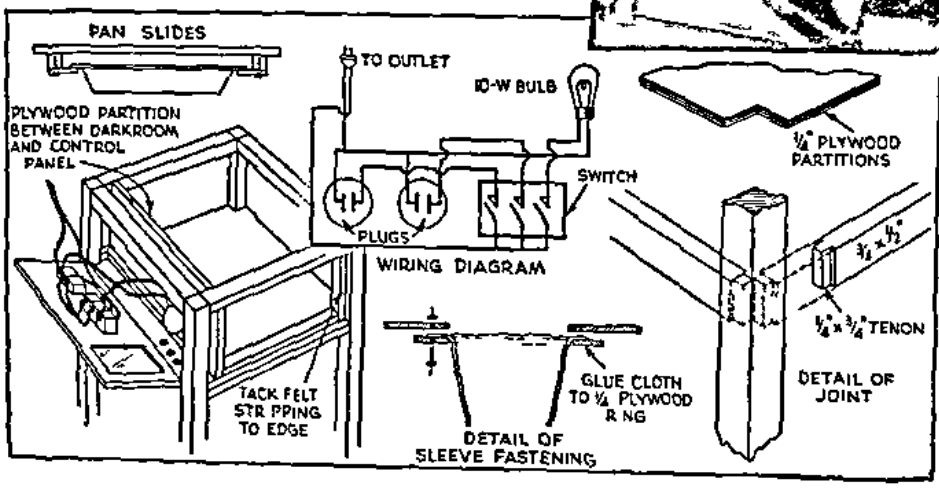
The storage compartment contains shelves for bottles and equipment The developing pans may be hung in slides at the top of the compartment so as to be out of the way and yet easily accessible A pocket can be provided on the door for additional equipment magazines and books

Underneath the storage compartment a small shelf is provided for holding the enlarging easel On the back of the cabinet a flat pocket holds the ferrotype sheets and also photo blotters A bar handle made from an old broom handle is provided for wheeling the cabinet which has 3" rubber wheels on the front legs

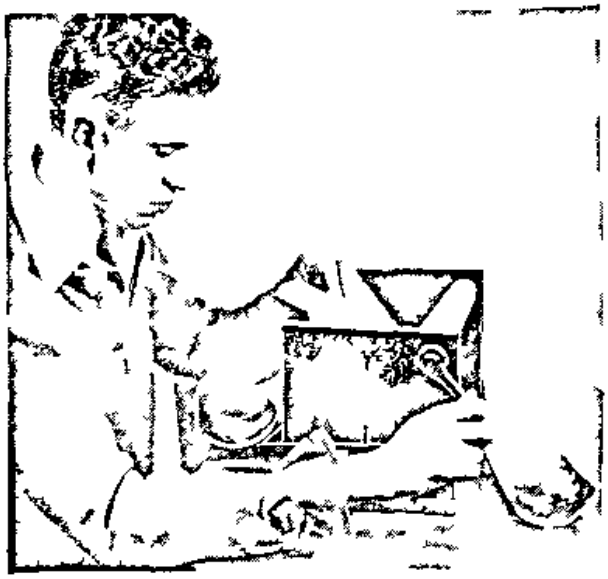
The outside is painted as desired The inside of the storage compartment should be a light color for greater cleanliness and to aid in finding articles in the dark The enlarger is mounted in the most convenient manner on top of the cabinet.

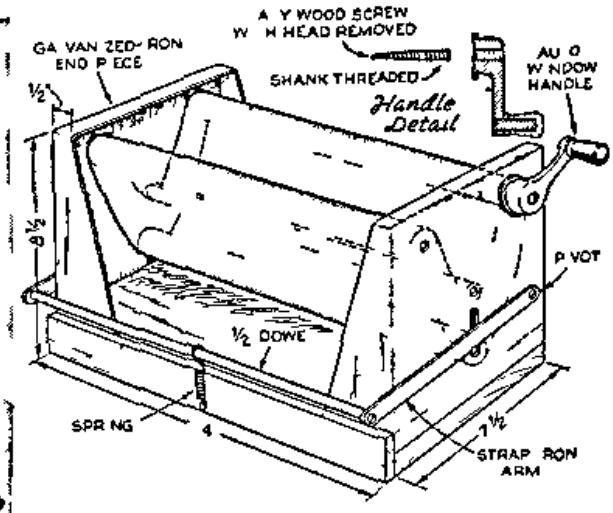






Top view cabinet opened up Door of darkroom compartment also acts as a shelf Note enlarging easel pulled partly out of its shelf at bottom The other photo shows how sleeves are used when loading a developing tank on the inside





The cloth belt s kept st etched by a sp ng that pul s down the ends of the lower roller

Print Straightener Takes Curl Out of Photos

TO STRAIGHTEN prints most amateur photographers use makeshift methods It s however comparatively easy to con struct a good print straightener

The one illustrated uses an endless cloth belt that pulls the print under a revolving metal rod The belt travels over four rollers three of them cut from broom handles 1 or more in diameter and the fourth a ½ metal rod fitted with wooden plugs in the ends to receive wood screws

A strap iron arm pivoted at one end rests on the wood screw in the center of the bottom roller and keeps some tens on on the roller although allowing it to re volve There is one of these arms at each end and they are joined with a ½" wooden dowel A small coil spring draws the dowel toward the base of the straightener One of the two upper rollers is fitted with an old automobile window handle for easy turning The cloth belt is a piece of toweling or other closely woven cloth that will not stretch appreciably

Prints should be run through the straightener as soon as they peel off the ferrotype plates If you desire to stra ghten old prints hold them above a pan of boil ing water until they are moistened a little by the steam —STANLEY JOHNSON

RETOUCHING PRINTS, PART 3 [*PHOTOGRAPHY*]

Sepia and Toned Prints These are best spotted with oil or water colors since the color shades may be readily obtained by mixing

Etching Dark specks or small areas may be etched to a lighter tone with any razor edged blade Use a very light scraping action and proceed care fully till the area being worked on matches the surrounding area

Surface Luster Where etched areas on the print are noticeable due to the lack of luster a coating of mucilage or gum dissolved in water will add the necessary gloss Gum from an envelope flap will do Experiment on the border of the print till the mixture (when dry) matches the luster of the emulsion In water color retouch ing the gum water can be mixed di rectly with the colors

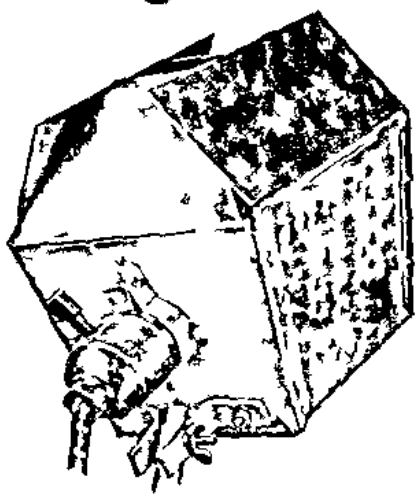
Permanence Dry spotting while handier is not as permanent as either of the two wet methods since it will smudge more easily

POPULAR SC ENCE MONTHLY SHOP DATA F LE



Four-Door Reflector Gives Perfect Light Control





THIS photographic lamp reflector has four doors so arranged that when they are partially closed a spot light effect may be obtained. Each door may be adjusted to screen light off from any area

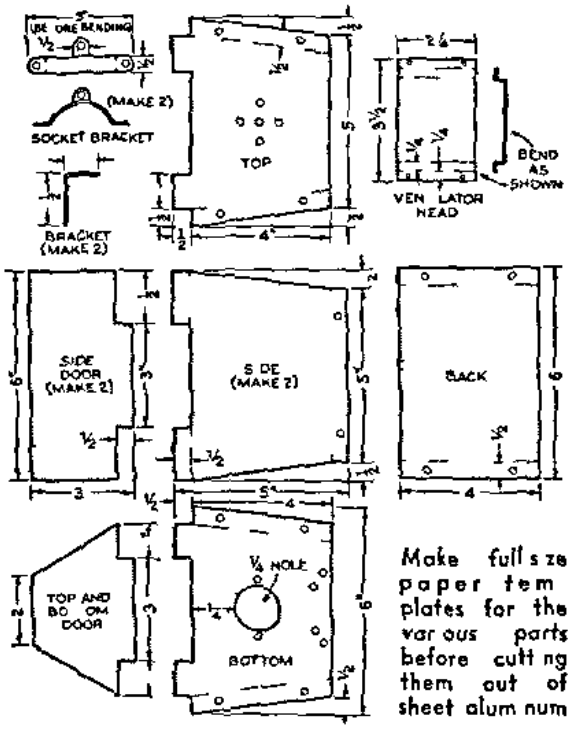
A sheet of aluminum at least 1/32 thick and 12" by 24" is sufficient for the reflector The one shown was made with only a few hand tools

It is best to prepare paper templates for all the parts before marking off the aluminum Do all cutting and drilling be fore assembling the parts with 1/8" alumi num rivets In bending the various angles I used two lengths of angle iron held to gether with two C clamps These acted as a vise

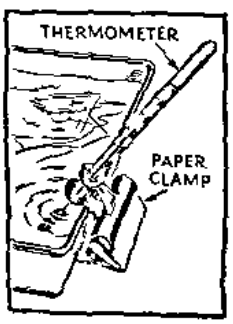
Two small pieces are cut as indicated to form a collar or bracket for holding the lamp socket The hinges for the doors are made by leaving protruding tabs and bend ing them around lengths of drill rod In this case No 48 drill rod was used The ventilating holes drilled in the top are covered with a small light baffle

Two pieces of aluminum rod 1" by 1/8" are bent and drilled to form brackets to support the lamp A short length of brass tubing fits between them and is held with a carriage bolt and wing nut

In obtaining the finish shown a small wad of steel wool was applied with a circu lar motion to form a series of spots If an etched or frosted finish is desired the aluminum sheet may be placed in a warm solution of caustic soda —FRANK CAPORAEL.



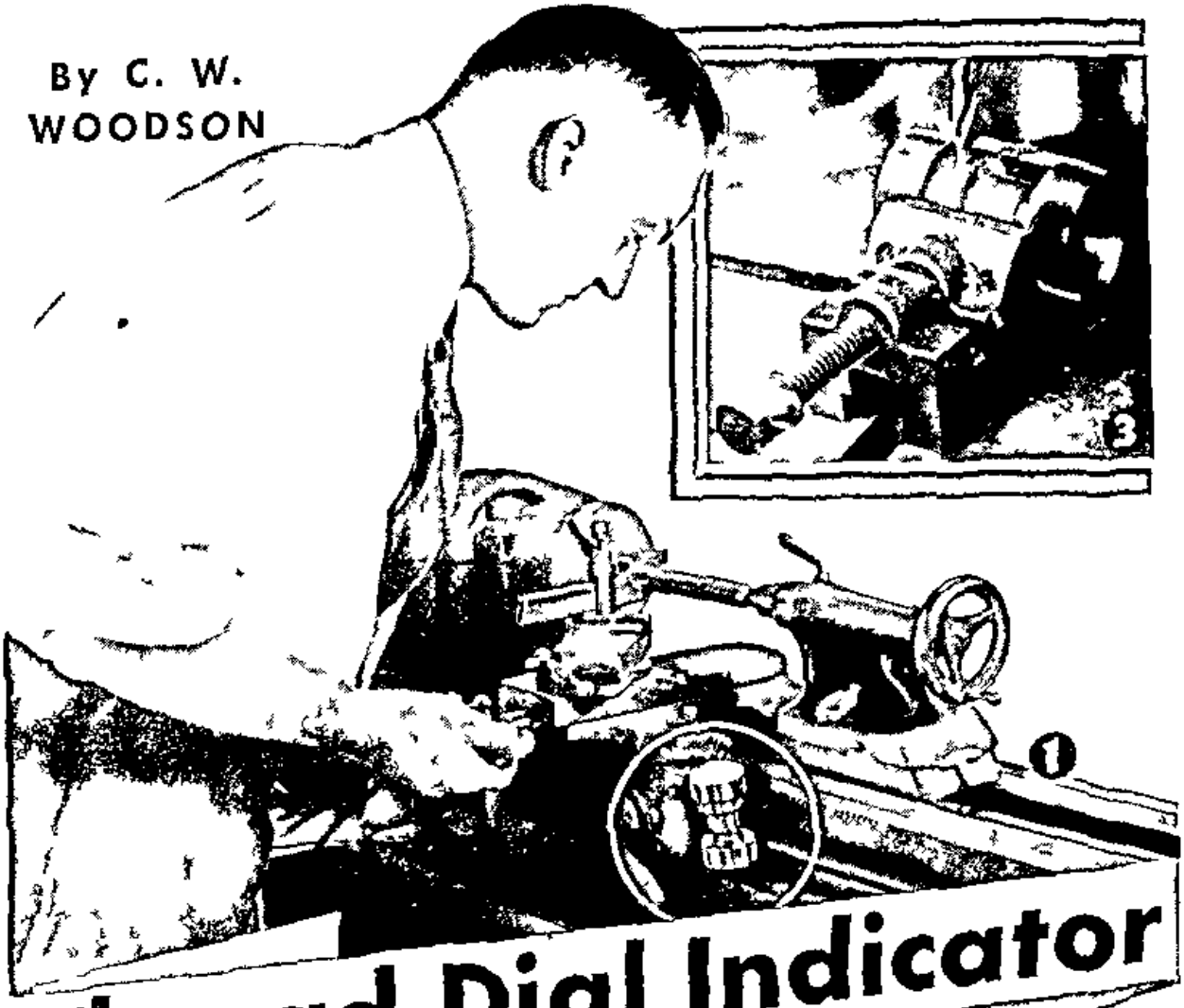
Make full size paper templates for the various parts before cutting them out of sheet aluminum



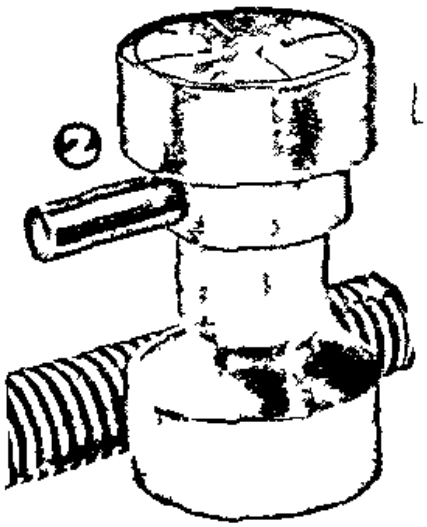
Paper Clamp Supports Thermometer in Tray

MANY amateur photographers prefer plain glass thermometers but these are particularly difficult to use when testing the tempera ture of solutions that have already been poured into trays One ex cellent way of supporting such a thermometer in a developing tray is to utilize a large spring paper clamp All that is necessary is to enlarge the holes in the clamp slightly to fit the glass tube The clamp rests on the table and against the rim of the tray but is not attached so the thermometer may be easily removed.—G H

By C. W. WOODSON

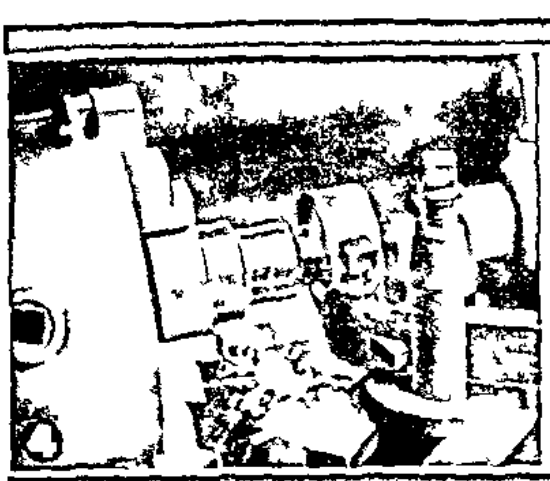


Thread Dial Indicator for the Lathe

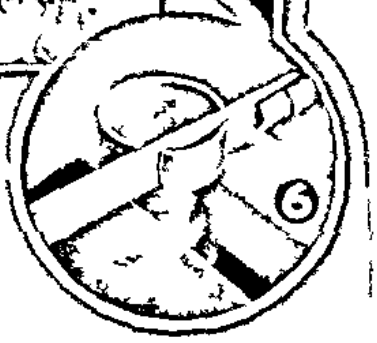


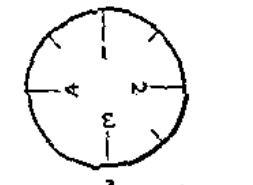
THREAD cutting in a wide range of pitches and diameters can be done on a small screw cutting lathe The coarser pitches require a number of cuts to complete the thread groove and in this operation the tool must be returned to the starting point for each successive cut There are two ways of doing this First by reversing the lathe which on long threaded work is quite slow Second by using a thread chasing dial or indicator that will allow the carriage to be disengaged from the lead screw returned rapidly by hand and re engaged so the tool will follow the original cut

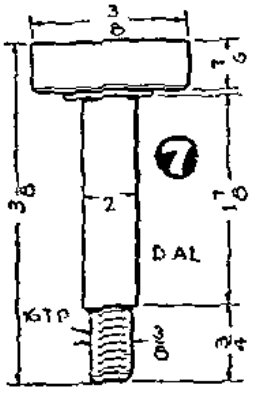
Building a chasing dial of this type is an interesting and instructive project especially as the work can all be done on the lathe itself The indicator shown in Figs 1 and 2 is made from cold rolled steel The shell or body (Fig 8) is turned from a solid bar as in Fig 4 carefully smoothed with a fine file and polished bright with a strip of emery cloth

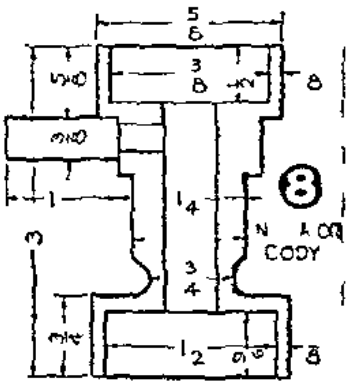


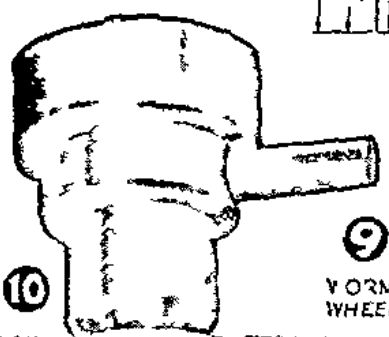


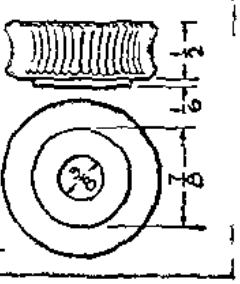














The shaft hole is then drilled and counterbored (Fig 5) to receive the dial on one end and the worm gear on the other Figure 6 shows a portion of the lower wall being cut away to allow the worm gear to mesh with the lead screw This opening was filed to shape with a large round file to fit snugly around the lead screw

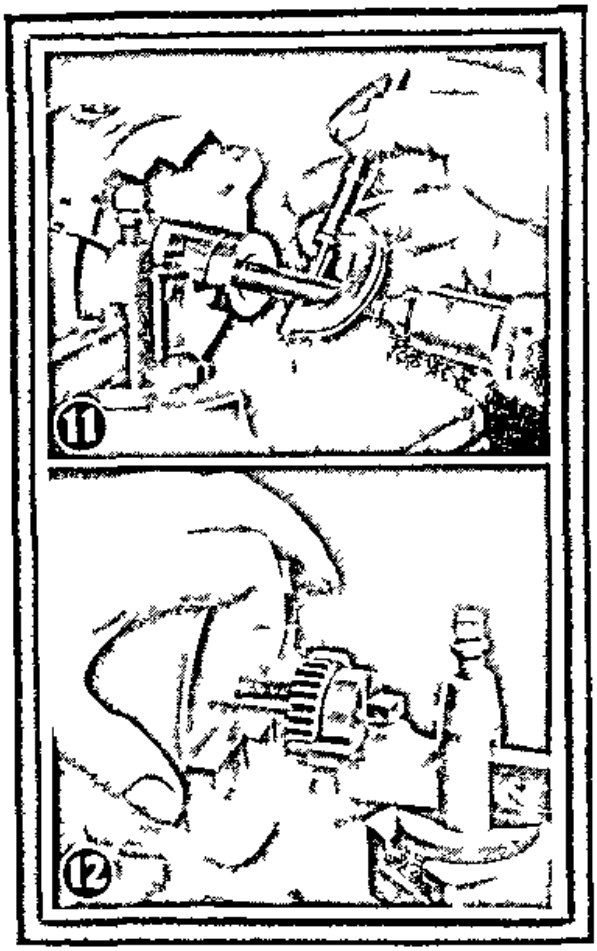
The hole for the supporting arm is being drilled in Fig 3 It is later tapped to receive the arm which is then made up and screwed tight ly in place

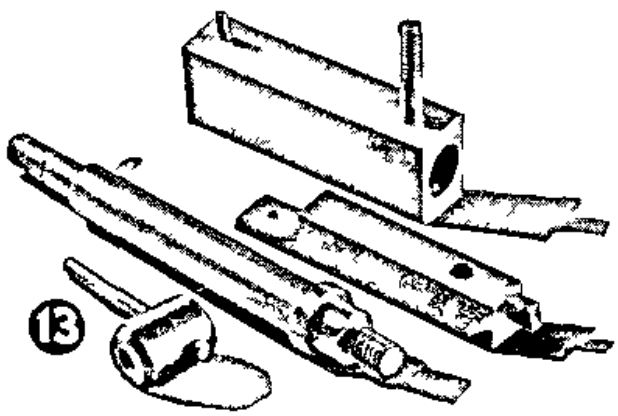
The dial and its shaft are cut from a solid bar as shown in Fig 11 and brought to the dimensions in the drawings (Fig 7) The face of the dial is graduated in eight di visions four of which are num bered

These indicating lines can be en graved on the dial with a sharp pointed lathe tool laid on its side The dividing is done by a 32 tooth lathe gear slipped over the shaft. Use the lathe tool as a stop as il lustrated in Fig 12 The line is then engraved by drawing the pointed lathe tool across the face of the dial with the cross slide screw The work is advanced four teeth of the divid ing gear again using the lathe tool as a stop and the operations re peated The four main divisions are numbered as shown in Fig 7 and an indicating mark is also stamped on the edge of the shell as shown in Fig 15

The worm wheel (Fig 9) has the follow ing diameters outer 1 437" throat, 1 353" pitch, 1.273" For cutting the 32 teeth on the blank a dividing fixture is needed In this case a suitable fixture was made as shown in Figs 13 17 and 18 to the dimensions given in Fig 14 A 32 tooth lathe gear was mounted on one end for dividing (Fig 18) and the gear blank was at tached on the other end

The fixture is clamped in a vise mounted on the cross slide of the lathe Thus is mounted at a slight angle to obtain the spiral in the gear teeth, which are then





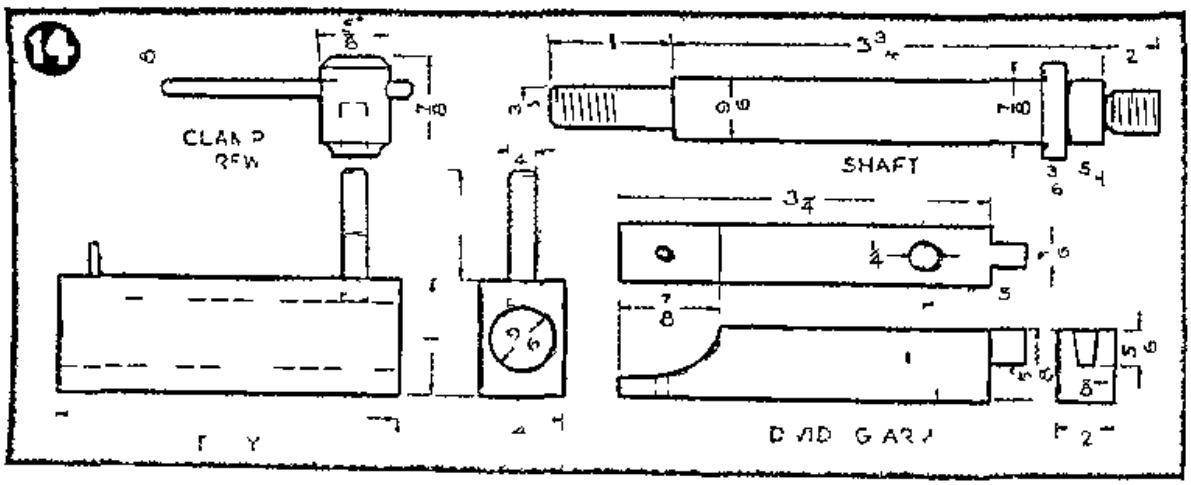
roughed out with a small milling cutter mounted on a mandrel as in Fig 19 After each tooth is cut the dividing arm is raised the gear advanced one tooth and the operations repeated until all the teeth are roughed out ready for hobbing

A serviceable hob was made for this particular job from a ⅞ N F tap After being annealed this was turned smooth to ¾" in diameter and new Acme threads eight to the inch were cut as in Fig 20 exactly duplicating those on the lead screw of the lathe The new threads were then backed off for clearance with a fine file and the hob was rehardened and drawn

Figure 21 shows the hob mounted in the chuck and supported by the tailstock of the lathe The gear is mounted to revolve freely It must be set at a slight angle (high on the left side) for cutting the gear teeth spirally to fit the pitch of the lead screw The cross slide screw is used to feed the gear to the revolving hob which furnishes the motion to the gear as the teeth are being cut When the gear has been brought to the required dimensions so that it will mesh perfectly with the lead screw the various parts can be assembled ready for use

In cutting threads with the indicator each line on the dial represents ½" of carriage travel so with all even numbered threads the half nuts on the lathe apron can be closed on any line on the dial For threads of an odd number close on any numbered line For threads involving a half thread per inch such as 11½ threads close on any odd numbered line

In cutting 11 threads per inch with the dial reading as at *A* in Fig 15 if the tool were withdrawn from the thread groove and moved back a distance equal to 4 or 5 lead screw threads it would not fit into a thread groove in the work However if it is drawn back 8 lead screw threads or a distance of 1" as shown at *B* this would bring the tool in line with a thread groove 11 threads

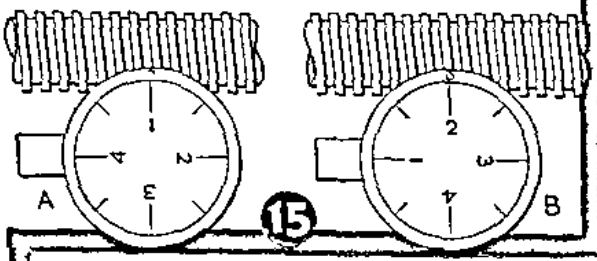


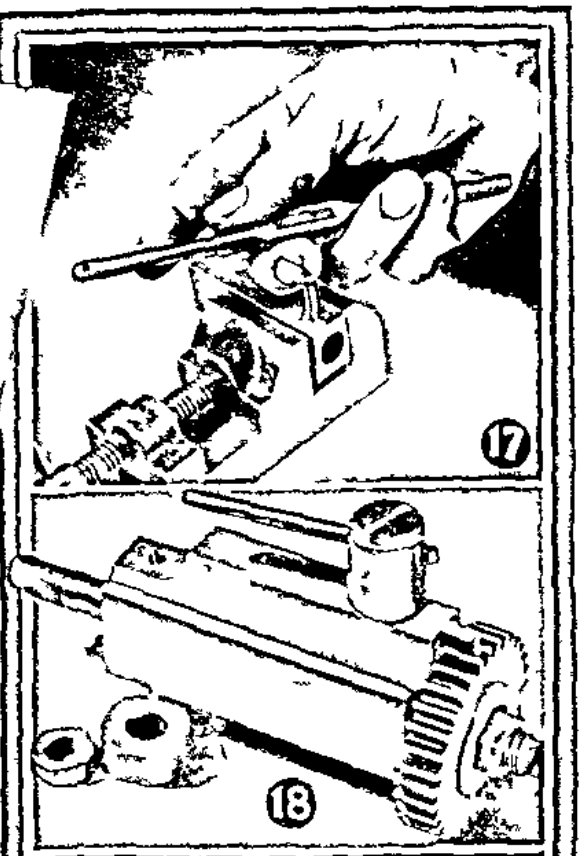


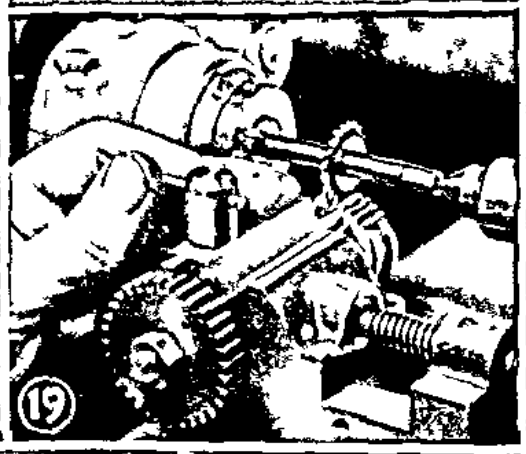
Making a trial assembly of the dial indicator

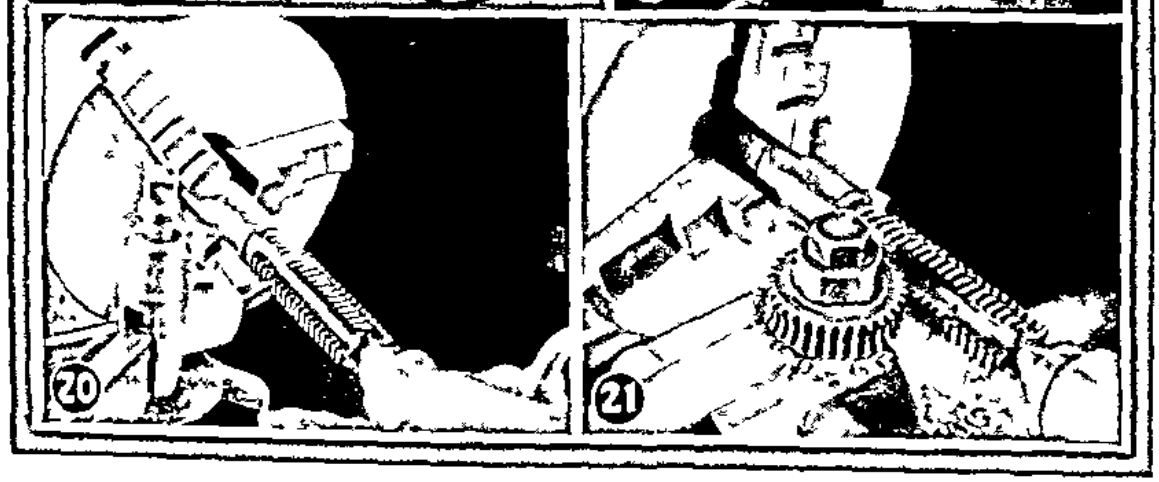
away The half nuts can therefore be closed on any numbered line on the dial that represents an inch of carriage travel and the tool will then follow the original cut

When cutting threads and a half thread per inch is involved such as 11½ threads, line No 1 or 3 on the dial, indicating 2" of carriage travel or 23 threads on the work, should be used in closing the half nuts





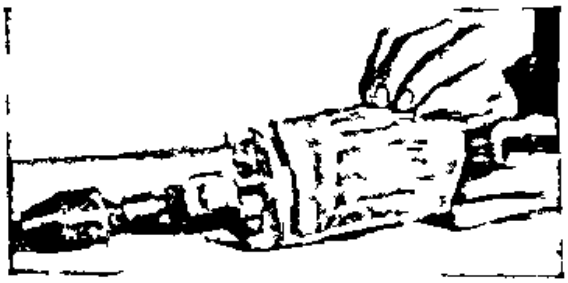






Oil Can Has Hook to Hang on Rung of Ladder

SERVICE men who are obliged to grease oil, and adjust overhead machinery or pulleys will find that a wire hook soldered on the oil can spout will allow the can to be suspended from a rung of the ladder thus leaving both hands free when necessary

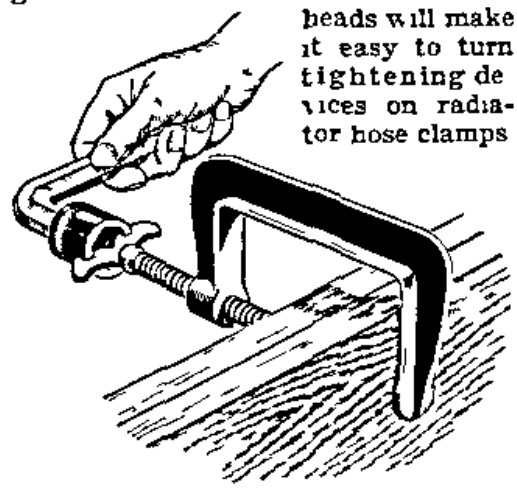


Soft Leather Case Contains Drills for Odd Jobs

BECAUSE he had often lost twist drills while on jobs outside the shop one mechanic made a holder of thin soft leather as shown above to strap to his portable drill Individual pockets were sewed to fit each drill rather tightly A circular elastic band was sewed to the bottom to hold the pockets to the drill snugly while a second band cut in two and provided with a small snap button was fastened to the flap The holder is so located on the drill body that the ventilating holes are not covered up

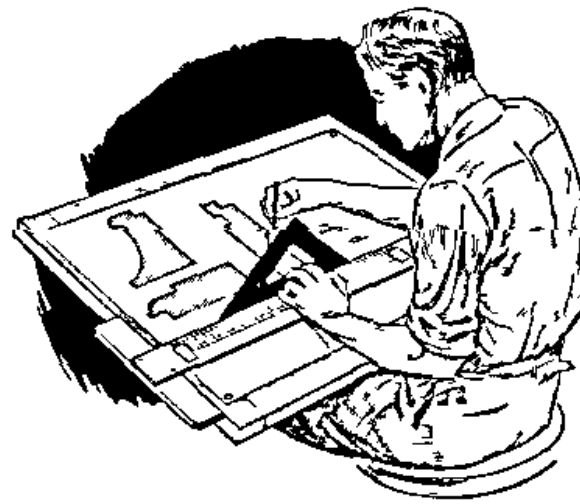
Slot in Socket Wrench Used for Tightening Wing Nuts

IF A SLOT about ⅛" wide and ⅛" deep is ground across the end of one of the larger heads of a socket wrench set, it forms a tool that will tighten or loosen wing nuts or thumb screws The most stubborn wing nut may be turned with its aid A narrower slot ground in one of the small wrench heads will make it easy to turn tightening devices on radiator hose clamps

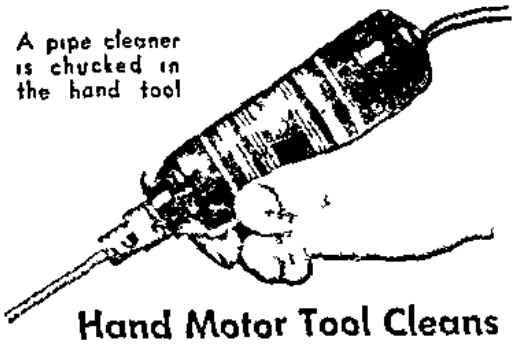


Graph Paper Stuck on Square to Aid in Crosshatching

TO INSURE equally spaced lines when crosshatching some part of a mechanical drawing attach a piece of ordinary graph paper along the working edge of the T square with cellulose tape Adjust the perpendicular edge of the angle to each succeeding line of the graph paper —MASSIMINO RAINONE



Fine medium or coarse crosshatching is obtained by moving the triangle one two or three spaces



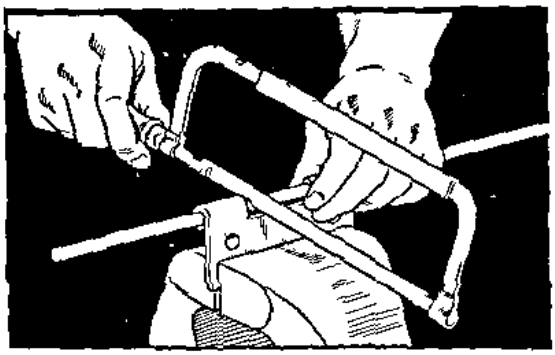
Hand Motor Tool Cleans Small, Deep Holes

AFTER drilling a large number of small deep holes in some castings a mechanic found that the quickest way to clean them out thoroughly was to use a pipe cleaner of the correct length in the chuck of a hand power grinder

Magnetic Ground Contact for Carbon Welder

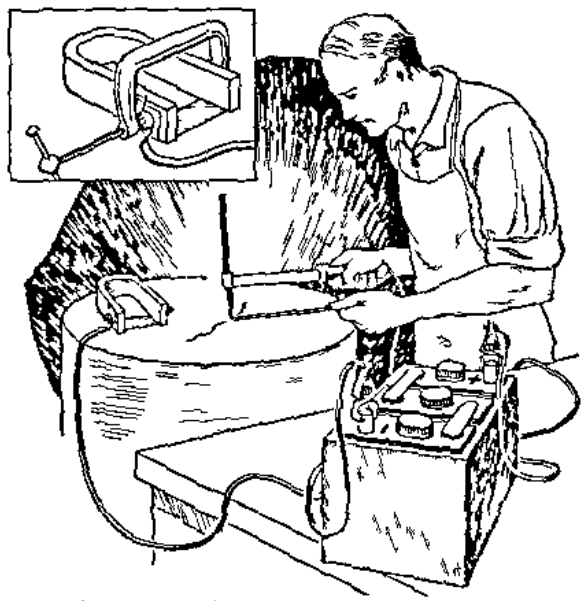
IN WELDING or brazing large sheet metal boxes tanks and cylinders with a low voltage carbon contact welder I often experienced difficulty in getting a good ground return because the usual battery clip could not be applied readily at any point This was overcome by using a large horseshoe magnet from an old magneto

A wide copper strip was attached across the legs as shown below and the return wire was connected to one of the screws The powerful magnet holds the copper strip firmly on any iron or steel surface flat or curved on which it is placed If the magnet is not provided with mounting holes a C clamp can be used to hold both the strip and the return wire to the legs as the magnet is too hard to be drilled —W C W

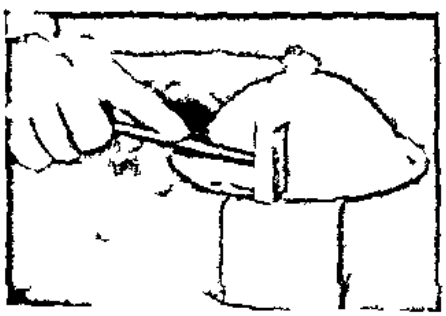


Half Hinge Holds Tubing While Being Sawed

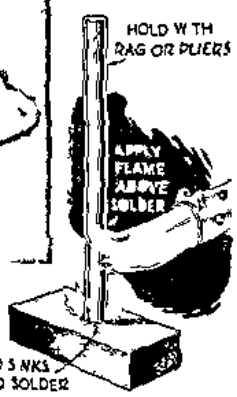
TO HOLD small copper tubing so that it can be sawed without being crushed one garage mechanic uses a half hinge placed in a vise as shown The tubing is inserted through the hinge pin holes One of the looped ends acts as a rest for starting



The magnet holds the copper strip on the surface and insures a good ground



Right the rod sinks into the solder when it is heated Above hammering out a kink on a polished surface



Soft Hammer Made of Bar Solder

A USEFUL little soft hammer for removing kinks and dents in polished surfaces can be made in a few minutes from a 2" length of ordinary bar solder and a 10" metal rod The handle may be attached by threading the rod end and tapping out a hole in the center of the solder or by applying heat from a blow torch to the rod just above the solder and letting it sink slowly into the head as shown When the head has become badly battered it may be removed and used as solder and a new section supplied in its place



File-Card Box

KEEPS SHOP DATA HANDY

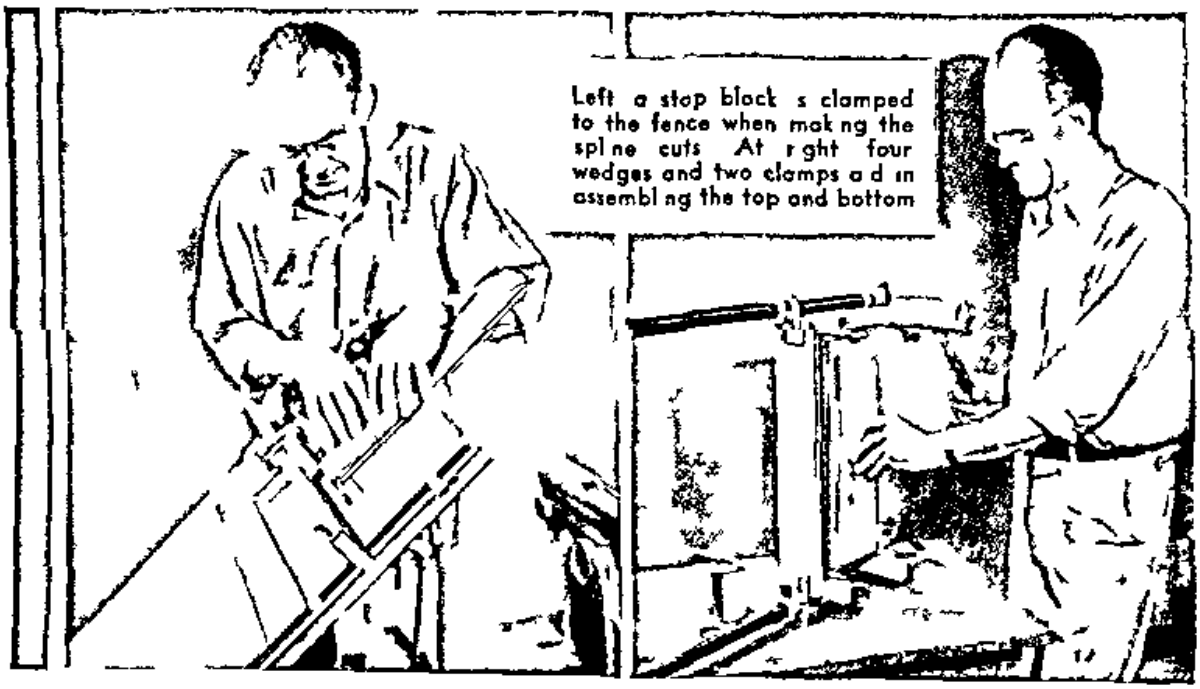
SINCE the introduction of the POPULAR SCIENCE MONTHLY Shop Data File many amateur craftsmen are keeping reference material in the form of 3" by 5" filing cards These require some type of file box and for those readers who take pride in owning the finest available shop equipment a special filing case for the cards has just been designed

The box has three compartments for cards which will hold as many as any reader will be likely to accumulate for years to come The bottom of these compartments slants upward so that it is easier to find a card. A wire rack is provided to keep in view the card or cards being used and the same rack also holds a magazine open for ready reference against the open lid

When the lid is closed it forms a slanting rest for small drawings or sketches or a magazine may be laid on it and held open by means of two wire clips which swing up from behind the box. In addition these clips will hold several 3" by 5" cards upright.

The original filing case which was constructed by Frank Hegemeyer a regular contributor to this department is a beautiful piece of cabinetwork The drawings show how he made it but the box would of course be equally serviceable if merely nailed together with plain butt joints

Construction is begun with the front, back and sides of the lower part of the box (Fig 1) The stock is surfaced four sides down to ⅝" thick and 3½" wide The top edge is shaped as in Fig 3 while the bottom edge has a ¼" by ¼" rabbet for the plywood bottom Cut the front back, and sides and miter the ends after which the saw cuts can be made for the maple splines



Left a stop block is clamped to the fence when making the spline cuts At right four wedges and two clamps aid in assembling the top and bottom

After gluing the lower part nail the bottom in place Make the two partitions (Fig 5) of plywood or hardwood and nail to the false bottom

The entire lid is cut from 7/16" stock Fasten the lid top to the frame with 3/16" dowels The locations of the dowel holes are made to coincide by driving small brads in the top of frame and tapping the lid top on the brad heads The handles are doweled and glued, and the lid rest (Fig 6) is screwed on A small trunk lock is added

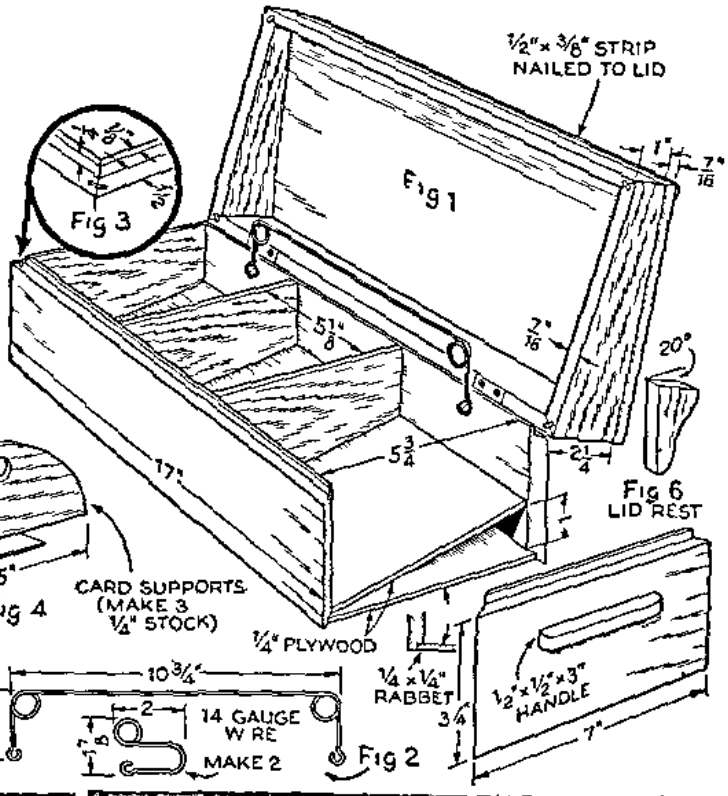
Card supports may be made as in Fig 4

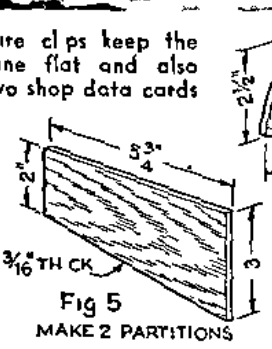
The clips (Fig 2) are formed by bending wire around a 5/8" metal rod The inside holder has a one and a quarter bend, and the outside clips have two complete bends

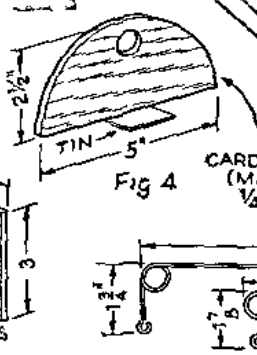
Use a fine grade of sandpaper for the final sanding and if an open grained wood has been used, apply a paste filler Varnish or lacquer the box, rub down with fine pumice stone and polish with a rubbing compound The inside can be stained later. Add rubber headed tacks to the bottom



Two wire clips keep the magazine flat and also hold two shop data cards



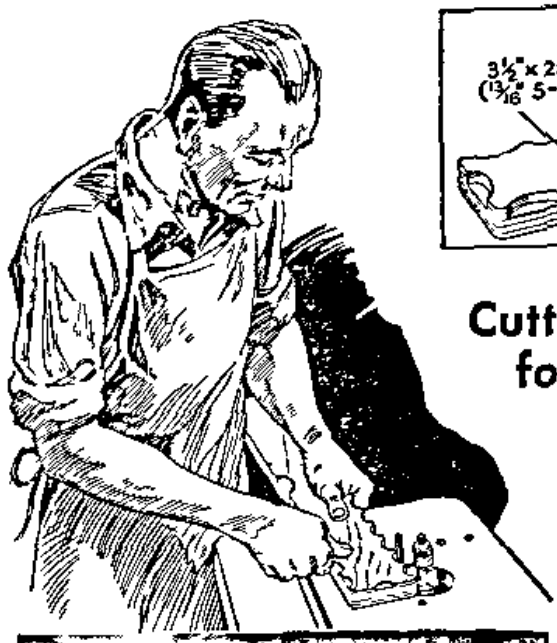


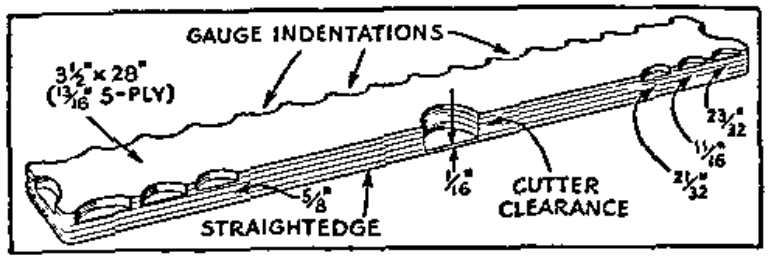






Left, the dowel holes in the lid top are bored ¼" deep. Note how the lid frame is used as a support Above fastening the lid rest to the back of the box The two wire holders and the handles are already attached





Cutter Gauge and Straightedge for Setting a Spindle Shaper

SHAPER cutters are quickly set to any desired height above the table with this gauge, and it also serves as a straightedge for aligning the faces of the fence if the fence is moved

Cut a piece of 13/16" five ply stock and joint the edges Set a wide cutter with the smallest available collar so as to clear the table 1/16", and cut full depth into the straightedge at the center This should be cautiously done, with a starting pin in use as for freehand work. With this indentation it is possible to align the fence with a collar, making use of this additional support at the point of cutting

Make the gauge indentations in steps of 1/32", ranging from 1/16" to ¾". In each case, try the setting first with a test cut in scrap stock. When the indentations are used with the bottoms down, the height of the lower edge of the cutter is gauged, when turned over, the height of the top of the cutter is indicated. If paper labels are pasted on the faces to identify the gauges the cuts should be made after the labels are attached, so that the thickness of the paper will be taken into account Protect the gauge with lacquer or thin shellac

FORGE WELDING, PART 2 *[METAL WORKING]*

1 Do not use coal until it is thoroughly coked. A smoky fire is not a hot fire The fire should be a solid, white hot mass of coals, above this body should be about 1" of blue flame

2 The beginner always forces his blower too much A low blast is preferable as it forces just enough air through the coal for the fire to consume Too much blast chills the iron rather than heats it.

3 Do not stick the pieces being welded too low in the fire There should be at least 1½" to 2" of live coals below the pieces being welded.

4 Never permit the pieces being welded to be exposed to the air while heating They should be covered with at least ¼" of coals.

5 There is a tendency for the beginner to burn the metal A careful watch must be kept of the fire At the first sign of sparks or "stars" the pieces should be turned in the fire and then removed for welding

POPULAR SCIENCE MONTHLY SHOP DATA FILE

FIRST STEPS IN Decorating Glass WITH A HAND GRINDER



Two tumblers filled with a dark beverage to show off the designs in the glass to best advantage

GLASS working of various types is gaining popularity among amateurs A very simple way to start is to grind designs indelibly into the glass with a small electric hand grinder This is sometimes called painting on glass although color is not used of course

The process offers abundant opportunity for expressing artistic talent, but those who do not find it easy to originate designs of their own can copy or adapt pictures to be found in magazines and books

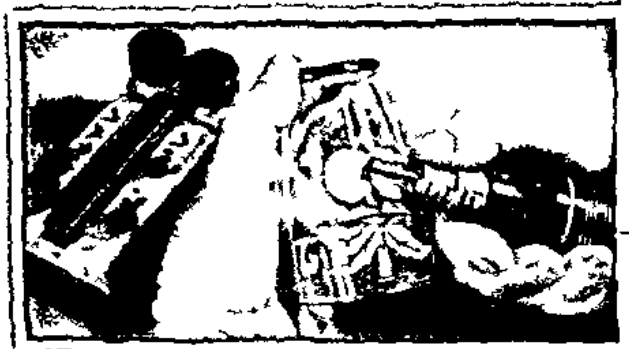
For your first attempts, all that you will require in the way of materials are several cheap beverage glasses The grinding is done with small green silicon carbide abrasive wheels of various shapes

Plain frosting can be done readily with a wheel shaped like an oversize pencil eraser Mount the wheel in the chuck of your hand grinder and bring it into contact with the glass using short strokes such as you would make with a paintbrush Do not leave the wheel in contact with the glass try to paint with it In the beginning no attempt should be made to shape the work by grinding deeply After some practice, however, you will find it possible to carve the glass to any desired depth

You can learn to follow the lines very easily by purchasing a small



To frost a glass hold the grinding tool lightly and use it to make short strokes as with a brush



Grinding a design that was fused onto the glass. Below cutting lines with a thin abrasive wheel



glass already decorated with a colored design that is fused right onto the surface Carefully grind away the design on the glass which will leave the same design in an etched or ground finish which greatly increases the value of the glass

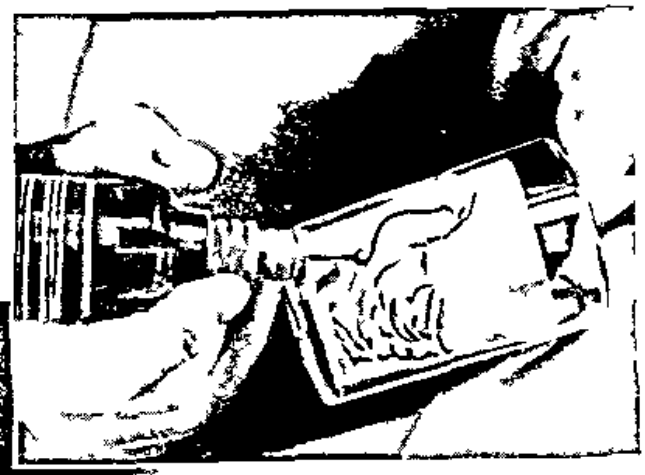
Once you have mastered this method obtain a child's ten cent paint book and from it select a simple outline such as a duck or a goose Tear this out and fasten it inside the glass with adhesive tape Then follow the outline on the outside with a small round abrasive wheel

If you make any errors they can usually be hidden by using a green rubber base abrasive wheel

You should have a dressing stone to keep the wheels in shape as they wear down Often it is cheaper to purchase fairly large wheels and keep them dressed to shape,

Right copying a design attached to the inside of the glass Below if the bottom of a glass is not perfectly formed grind it flat with a glass square and silicon carbide and water





rather than to buy very small wheels at the start. Some workers use a lubricant consisting of a small lump of camphor dissolved in several ounces of turpentine into which the wheels are dipped occasionally This is not necessary however with the very simple work just described.

With practice you will find that a variety of effects may be obtained by this method of grinding —KENNETH MURRAY

If you are interested in glass working and would like other articles on this subject to be prepared for publication in later issues please send a post card to the Home and Workshop Department Mention any glass projects you would especially like to make

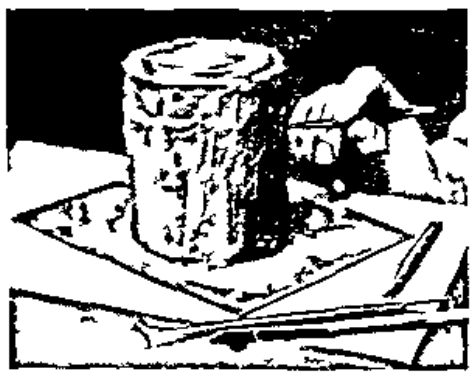
MODELING MATERIAL

[FORMULAS]

The following formula for an inexpensive modeling material offers unlimited possibilities to craftsmen designers, and artists A quantity if mixed dry may be kept in a dry place indefinitely

Mix thoroughly two parts by measure of asbestos paste (powder used for insulating boilers steam pipes etc) and one part Portland cement When ready to use add just enough water to make a thick paste The materials remain plastic for from twelve to twenty four hours This allows ample time to mold it into any form desired If it is then set aside to dry slowly it will become almost as hard as stone It is not affected by either heat or water

The material may be molded with the hands or worked with modeling tools into book ends jars boxes bowls plaques and many other articles.



POPULAR SCIENCE MONTHLY SHOP DATA FILE

Square-Headed Candlesticks

TURNED IN THE LATHE



CLOCKED PROJECT
Average Time
5½ hours

BY A UNIQUE but simple method a pair of square headed candlesticks can be turned from one block of walnut Mount a block about 4 thick and 4¾ square in the lathe and turn it as illustrated in Fig 1 Leave a ring around the center 1⅞" wide and ½" deep and undercut the sides as shown Turn the sides making them spherical and true and sand them smooth

Remove the piece from the lathe remount as in Fig 2 and cut off a part of the ring as indicated leaving a section 1⅞" square which will later become the candle socket Note that these sides are also undercut Cut off the lower sides to form a spherical shape and sandpaper well

Now remount the block in the lathe as shown in Fig 3 and cut out a center section ⅝" wide Removing this section cuts the candlesticks apart Each is then fastened in turn to the faceplate so that a ⅞" tapered hole can be bored for the candle (Fig 4)

Sand the wood to a flawless surface and apply three thin coats of shellac rubbing them down between coats Glue felt on the bottom —BENJAMIN NIELSEN

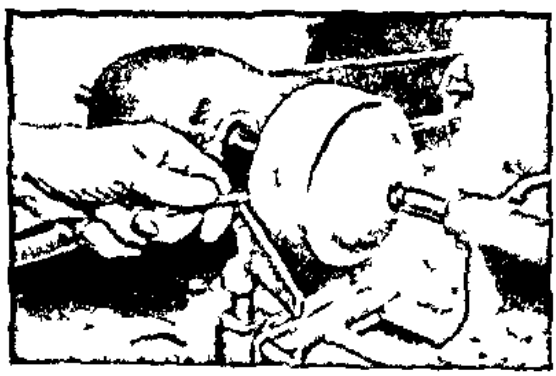


Fig 1 Turn a ring 1⅞ wide in the center of the block undercut it and then round the sides

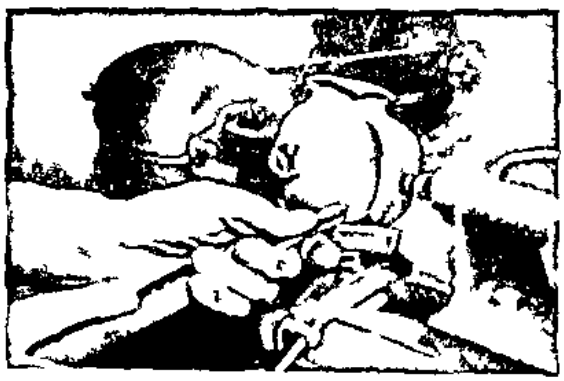


Fig 2 Change position of turning and cut off part of the ring leaving a section 1⅞" square

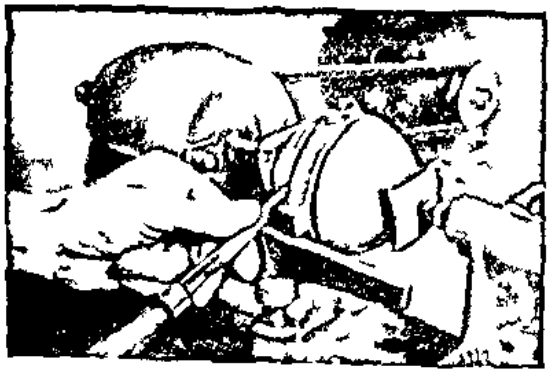


Fig 3 Remount the block and mark center section ⅝" wide Cut this off to give two parts

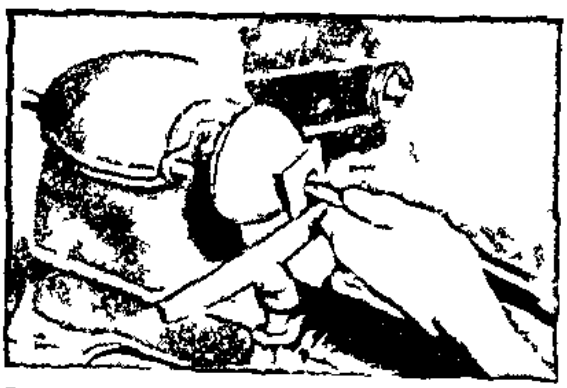


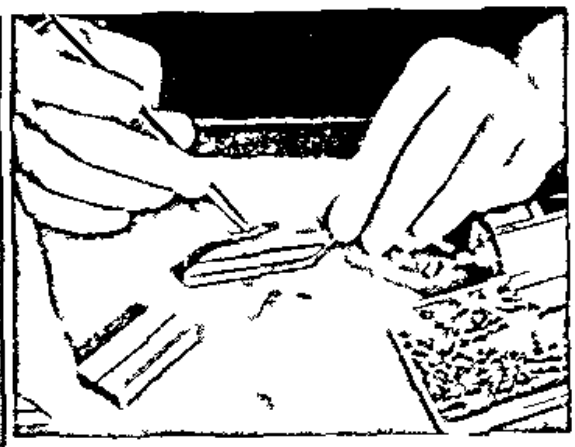
Fig 4 Attach each holder to the faceplate so a ⅞ tapered hole can be bored for the candle

DOROTHY Alphabet-Soup

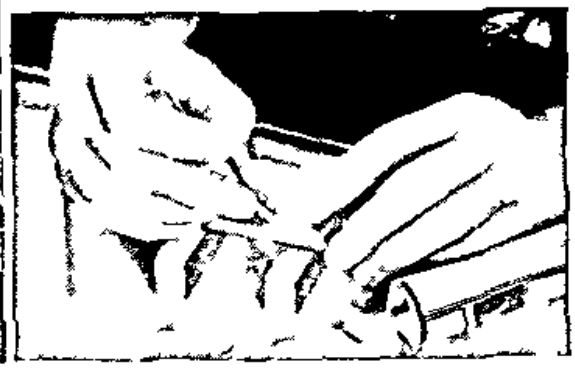
A FAST-SELLING NOVELTY AMONG



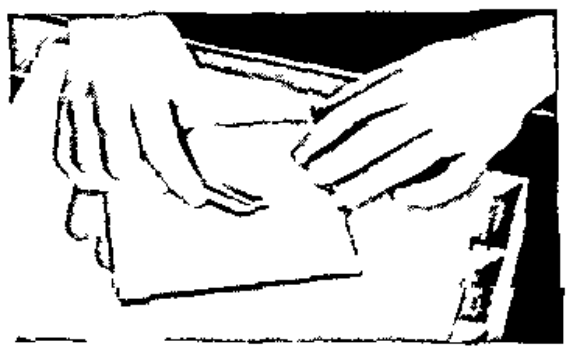
The p ns a e f n shed w th clear brush ng lacquer



A small safety p n s cemented n the g oove



The lette s a e attached w th cellulose cement



A l ght rub on sandpaper evens up the letters

HIGH SCHOOL students in various sections of the country have de veloped paying spare time busi nesses by making name p ns of alphabet soup letters glued to wood bases The cost of materials is so low that the usual selling price of a d me a pin leaves a good margin of profit

The wooden blanks are cut from aromatic red cedar mahogany or other suitable wood in long strips A good size is 3/16 thick and $\frac{1}{2}$ or $\frac{5}{8}$" wide A shallow groove is made lengthwise along the center line of one s de of each strip with a fine saw this is to receive an ord nary small safety pin The strips are then divided as required into the proper lengths The cuts may be straight across at a 45-deg angle or curved

After the front surface edges and ends have been sanded smooth the safety pin is fastened with quick-drying cellulose cement a drop or two being sufficient Place the pin so it can be opened easily

Alphabet soup letters which can be purchased for ten cents or less in packages contain ng hundreds of pieces are glued to the front surface of the block with the same

Name Pins

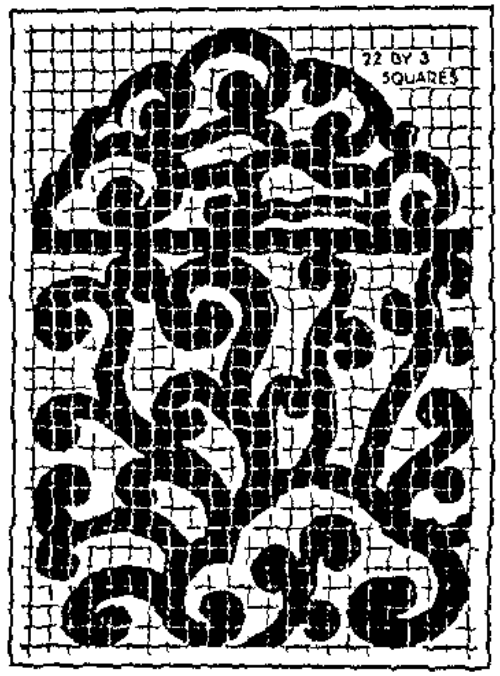
SCHOOLGIRLS

kind of cement They should be applied in such a position that the safety pin can be inserted by holding it with the point to the left of the wearer The letters may be staggered aligned carefully or arranged in any attractive manner to spell out names, nicknames school initials society names and the like Sharp pointed tweezers are convenient for handling the letters and a shallow box containing compartments like a type case is handy for storing the letters when sorted After the cement has set the letters are evened up by rubbing them on fine sandpaper such as No 00

The dust caused by sanding is brushed off any surplus cement is removed with a knife and the front and edges of the pin are given a coat of clear brushing lacquer This further secures the letters to the wood and in the case of cedar brings out the grain and darkens the color to a beautiful red Sometimes the letters are painted but the natural finish is generally regarded as more attractive With reasonable care the pins last indefinitely —ROY ELTON

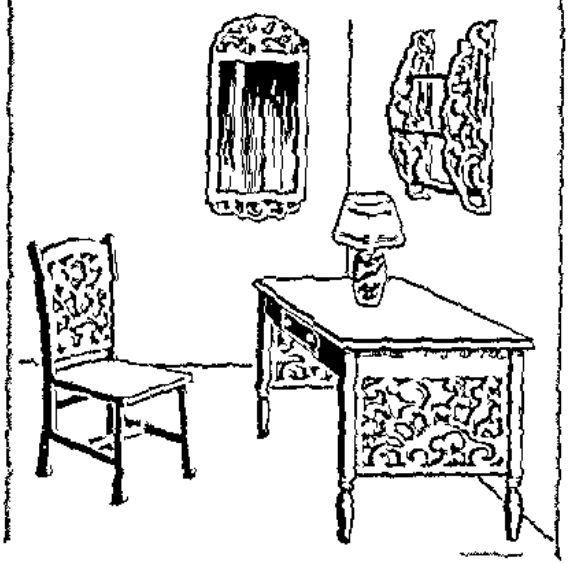


So attractive are the pins they sell on sight



A Pattern for Cutting Chinese Scrollwork

Those interested in scroll saw work will find that an all over Chinese pattern such as that shown above is adaptable to a great variety of projects several of which are sketched For use in garden furniture or outdoors cut the panels from outdoor plywood This type of design is also suitable for sheet metal grilles The pattern can be enlarged to any desired size by drawing squares and copying the outline through them



Colorful Little Serving Tray Shaped Like a Duck

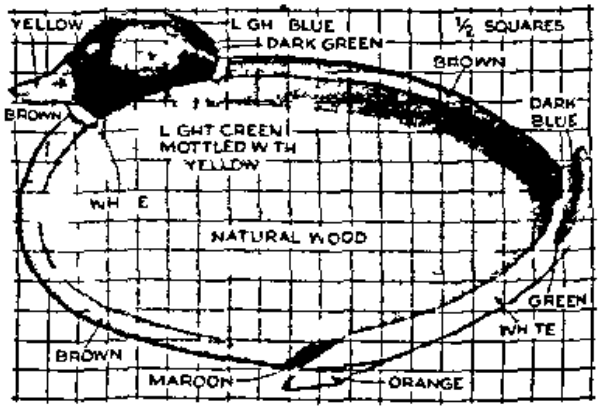
CUT out in the general form of a duck this colorful little serving tray which can also be used as a nut bowl may be made by any craftsman who has a scroll saw and equipment for routing The original de signed by members of the Metropolitan Junior Achievement New York is shaped from a block of birch about 1⅝" by 7" by 10"

The general outline is first scroll sawed then the interior is routed on a drill press The tail head beak and feet are shaped with knife and sandpaper These parts as well as the upper edge of the tray are painted but first the whole may be given a protec tive coat of clear lacquer if de sired

This project makes an attrac tive gift and also sells readily

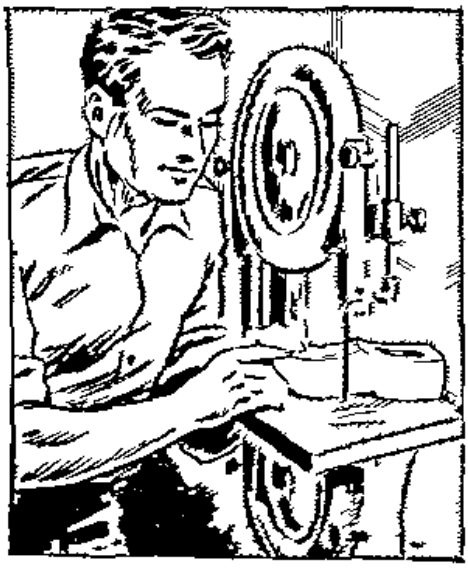
CLOCKED PROJECT
Average T me 4½ hou s





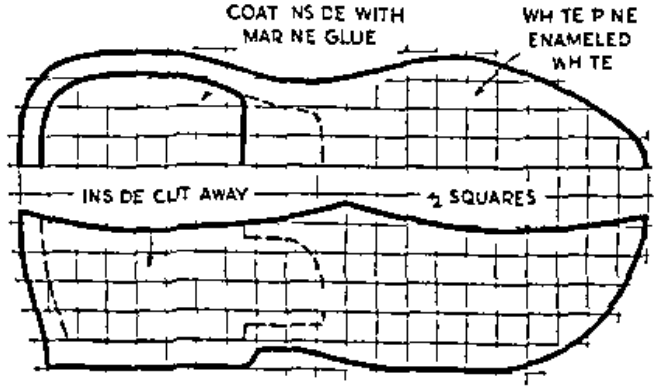
Dutch-Shoe Flowerpot Holds Two Tulip Bulbs

A BLOCK of soft white pine 3" by 5" by 8" is used for making this Dutch shoe flower-pot for tulip bulbs Draw the outline on the wood and remove the excess with a band saw In the heel hollow out a space as shown so as to provide room for two bulbs Work the outside down with a drawknife and block plane Sandpaper well and give the inside of the heel two or three coats of so called C quality marine glue The outside may be enameled white and trimmed with blue or some other clear attractive color



The shoe is shaped on the band saw and completed w th a drawkn fe and a plane





Etched Sundial

IN BRASS OR COPPER

CLOCKED PROJECT

Average Time 6 hours

EITHER brass or copper may be used for making this sundial It is laid out to register approximately correct time anywhere from latitude 25 to 50 deg north which includes all of the United States as well as part of Canada and Mexico

Most sundials are made of brass but for those who like an antique green finish copper is better because when exposed to the elements it will take on a natural verd green surface quicker than brass.

Lay out the dial on paper as shown Cut out a disk of the metal to be used—14 gauge is heavy enough Lay the pattern over the metal place a sheet of carbon paper between and with a hard pencil trace the face of the dial on the metal

Remove the pattern and use a fine brush to paint the numerals and lines on the metal with asphaltum varnish Be very careful to get straight even lines If any lines are not perfect finish the job and let it dry hard then scrape away the excess asphaltum

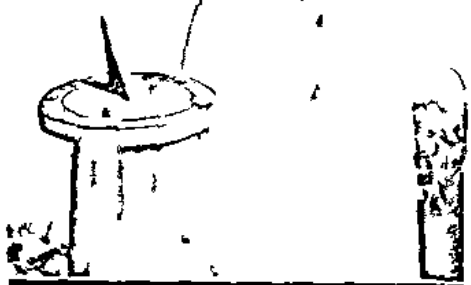
Lay the dial on a perfectly level surface and build a fence around it with putty paraffin or modeling clay It must be leakproof To about one third teacupful of water add very slowly and cautiously a like amount of commercial nitric acid Pour this carefully over the dial and let it etch until the acid stops working Then add a little clear nitric acid Continue adding acid from time to time and rock the piece occasionally so as to insure even etching Do not allow the acid to come in contact with hands or clothing With the metal at a temperature of around 60 deg the etch should reach a depth of about 0 005" in one hour

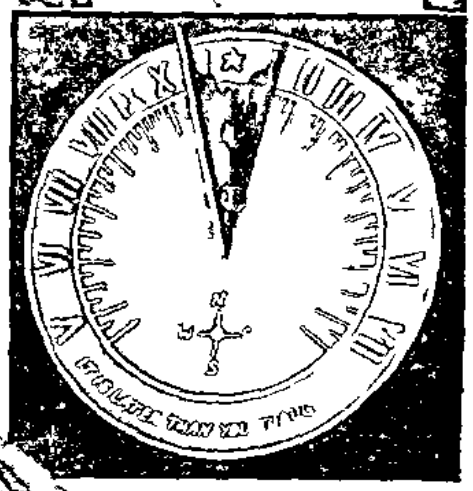
Pour the acid out Wash well remove the asphaltum with kerosene or lacquer thinner and polish the piece

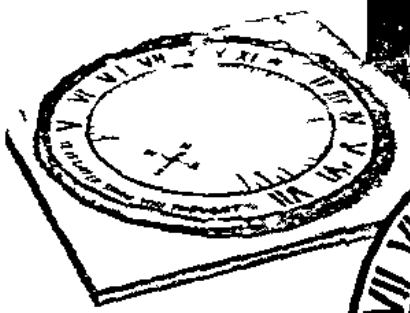
The style or gnomon for casting the shadow is cut from the same material and riveted in place as shown with brass escutcheon pins If a polished finish is desired coat the surface evenly with thin white shellac—D H



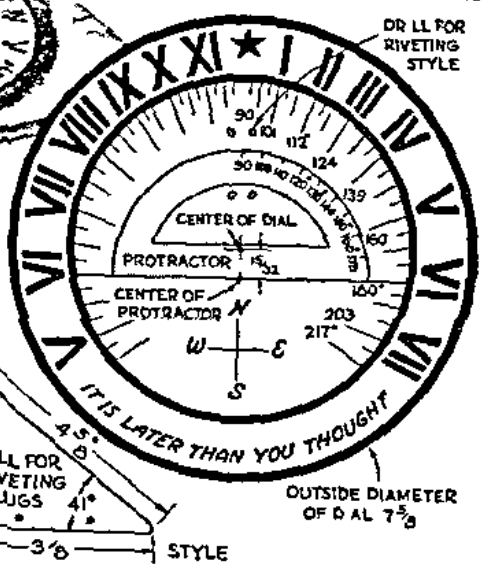
The dial is mounted on any appropriate type of pedestal

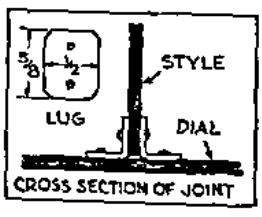






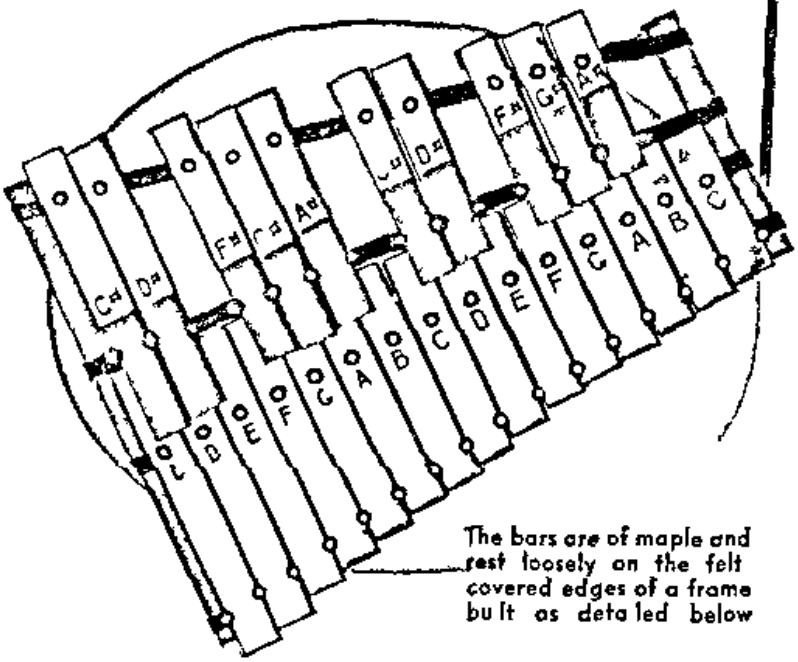
A fence of modeling clay is built around the dial and acid poured on the metal in order to etch it





AN EASILY PLAYED MUSICAL INSTRUMENT ANY WOODWORKER CAN BUILD

TWO-OCTAVE CHROMATIC



The bars are of maple and rest loosely on the felt covered edges of a frame built as detailed below

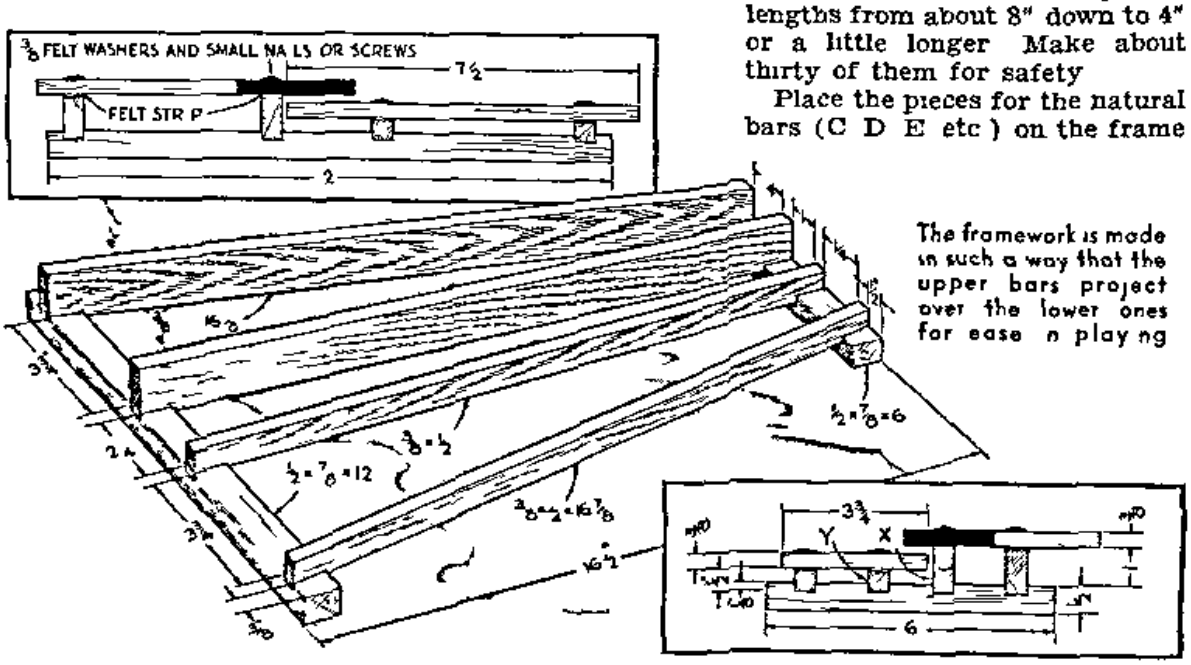
A XYLOPHONE is one of the simplest musical instruments to construct The cost is trifling yet the finished instrument if accurately tuned will be quite as good as those sold in music stores

The tone of a xylophone is soft and pleasant Even children can learn to play it without difficulty One valuable feature is that it serves as a good introduction to the study of the piano since the piano keyboard is laid out in exactly the same way Provided it is tuned to standard pitch it can be played with other instruments or with a piano accompaniment

The frame may be of pine or whitewood Cut the pieces to the given dimensions place them as shown groove the shoes ⅛" deep to receive the stretchers and fasten with glue and brads Then block plane the ends of the stretchers to suit the ends of the frame Stain the frame any desired color and glue a ⅜" wide strip of thin felt on the top edge of each stretcher

Make the bars a full ⅝" by ⅞" to allow for smoothing Fourteen lineal feet will be required to allow for spoiling some in tuning They should be of thoroughly seasoned hard maple of as nearly uniform texture as possible with the upper corners slightly rounded as indicated Cut them in graded lengths from about 8" down to 4" or a little longer Make about thirty of them for safety

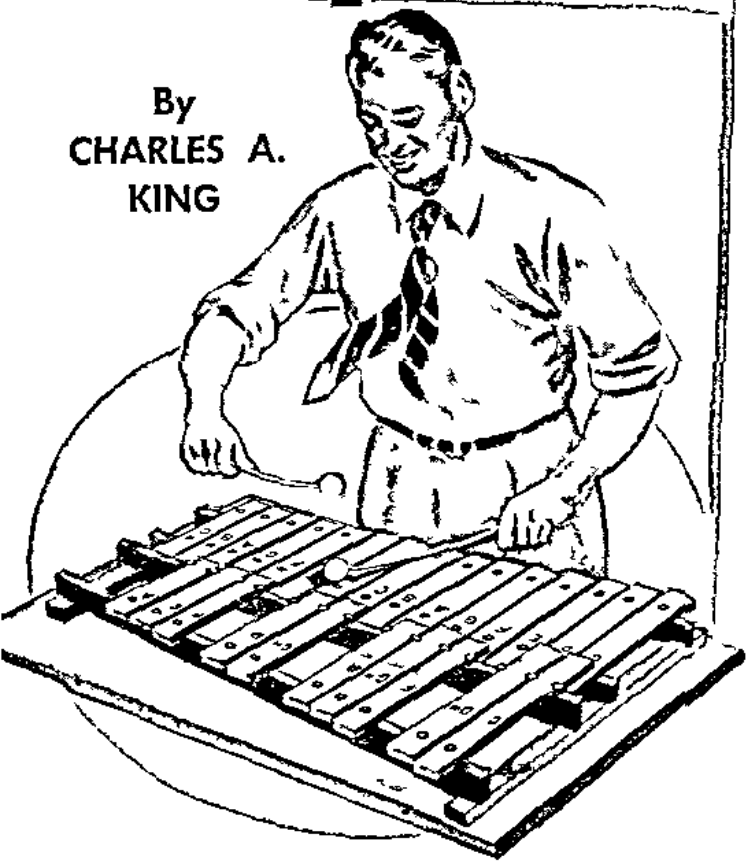
Place the pieces for the natural bars (C D E etc) on the frame



The framework is made in such a way that the upper bars project over the lower ones for ease in playing

Xylophone

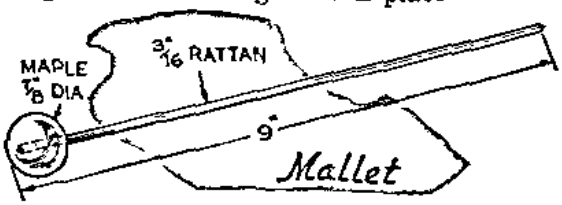
By CHARLES A. KING



so they just clear the 1" stretcher as at *X* Mark the line of the center of stretcher *Y* on the bars and drill a ⅛" hole through the *center of each bar In the case of the* sharp and flat bars (C sharp, D sharp, F sharp, etc) simply drill a ⅛" hole through them 1" from the end as shown

Place all the bars in position, center and *drill a small hole in the stretchers for each* bar, and drive a temporary brad through the hole in the bar into that in the stretcher to hold it

Two mallets must now be made The *heads are turned wooden balls* ¾" or ⅞" in diameter Fit a 3/16" rattan handle 9" long into each and glue it in place



In tuning, strike the longest (C) bar with a mallet and compare its tone with that of C one octave above middle C on a piano Tune the C s, E s, and G s first, then the bars between Tune the sharp bars by the tones of the natural bars above and below them To raise the tone of a bar, saw a little off one end of it to lower the tone, make a shallow saw cut in the back of the bar Avoid the latter if possible, for it deadens the tone

Blacken the sharp bars as shown While these are customarily marked C sharp D sharp etc, it is understood of course, that C sharp is also D flat, and so on

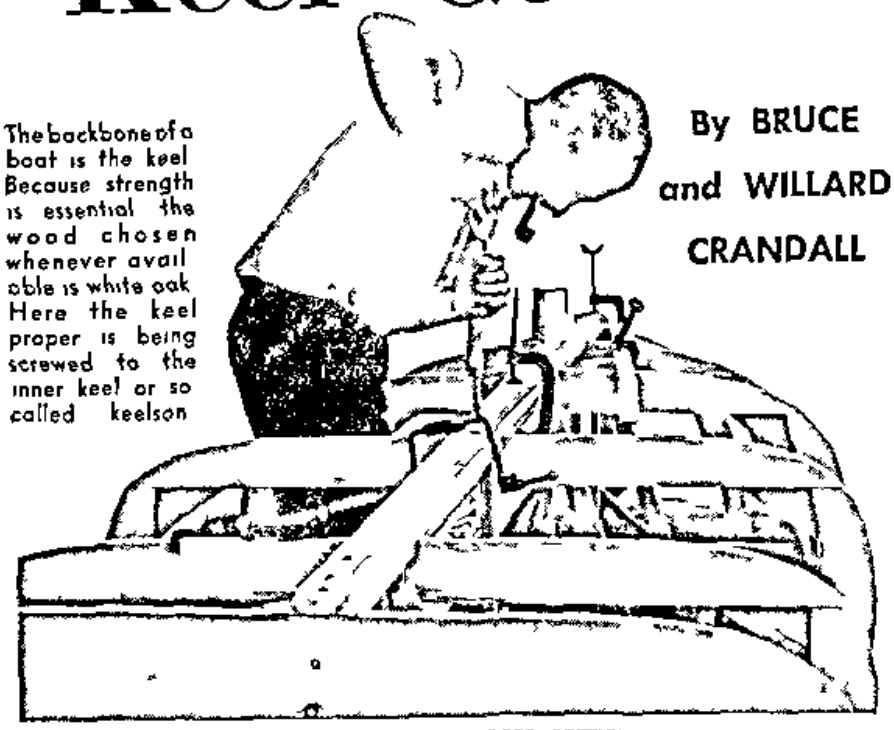
Make felt washers ⅜" in diameter and drive a very thin, loosely fitting ⅞ screw or an ornamental upholstery nail to fasten each bar *permanently Be sure the* bar is not held rigidly, or vibration will be restricted The writer merely used cut off threepenny finishing nails in making the xylophone shown in the photograph. Straighten the bars until they are *all parallel then drill small holes* in the other stretchers between each pair Drive screws or nails with felt washers under the heads to separate the bars and keep them aligned *These screws or nails also* must be arranged so as not to prevent the free vibration of the bars Place four rubber headed nails under the corners of the frame to serve as feet

How to Reglue Chair Joints So They Won't Come Apart

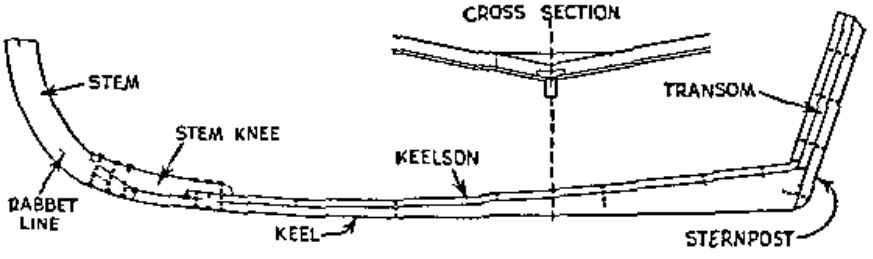
THE amateur craftsman who tries to mend a chair by driving nails through the legs into the rounds or rungs is piling up trouble for himself Not only are the joints *likely to loosen soon after the chair is* placed in use, but when permanent repairs are necessary, the nails may make it impossible to take the chair apart without breaking it Screws hold better than nails, but any method of repairing a chair short of taking it apart, cleaning off the old glue, and regluing throughout will not be efficient. This work should be done during dry weather or when the chair rounds are well shrunken by artificial heat. The rounds should also be heated before gluing, otherwise they may shrink in time and break the film of glue When the joints fit very poorly, use metal chair-round fasteners

Keel Construction

By BRUCE and WILLARD CRANDALL



The backbone of a boat is the keel Because strength is essential the wood chosen whenever available is white oak Here the keel proper is being screwed to the inner keel or so called keelson



Keel Assembly of a Small Rowboat

Another type of construction calls for a fairly deep keel One end of the keel is spliced to the stem the other end is fastened to the sternpost

ON MOST small boats the keel serves several purposes It acts as a rub strip to protect the planking from damage, aids in keeping the boat on a straight course, and at the same time is usually the most important longitudinal member from the standpoint of strength

In large boats and in all round bottom boats the keel is virtually the backbone it supports the ribs stem and transom and takes most of the stresses to which the boat is subjected In many modern small V bottom and flat bottom boats however, the importance of the keel is greatly reduced because the chines battens, and planking take up most of the fore-and-aft strains

Keels fall into two general classifications —deep keels that are sawed to shape and flat keels that are bent into position along the curve of the [illegible] line Because of its strength white oak is almost always the best material to use for a keel except in a few localities where water conditions make it impractical.

In order to prevent leaks between the keel and the bottom plank next to it, that is the garboard plank a rabbet is either cut the full length of the keel, connecting with the stem rabbet, or an inside keel is used to serve the same purpose The inside keel goes by various names such as keelson, apron, keel batten, or lay board

This keelson is screwed, bolted, or riveted to the keel and is always sufficiently wider than the keel to provide plenty of bearing surface for fastening down the garboard plank The two-piece keel thus formed is more practical for most small boats, not only because it saves the work of cutting the rabbet, but because two pieces are much more easily bent into position than one Except where the bottom of the boat is flat, the surface of the keelson must be beveled so that the garboard plank will fit against it perfectly The better the two surfaces fit, the less chance there is of a leak

The keel on a cross planked flat-bottom boat is usually only a flat board fastened to the planking, either on the outside or inside, and its principal function is to prevent leaks by holding the planks in position. In fast boats of the hydroplane type, the outside keel is usually omitted altogether, to reduce friction

At the bow, the stem and stem knee are usually bolted and screwed to the keel, and at the stern, the transom and transom knee are fastened in the same way All

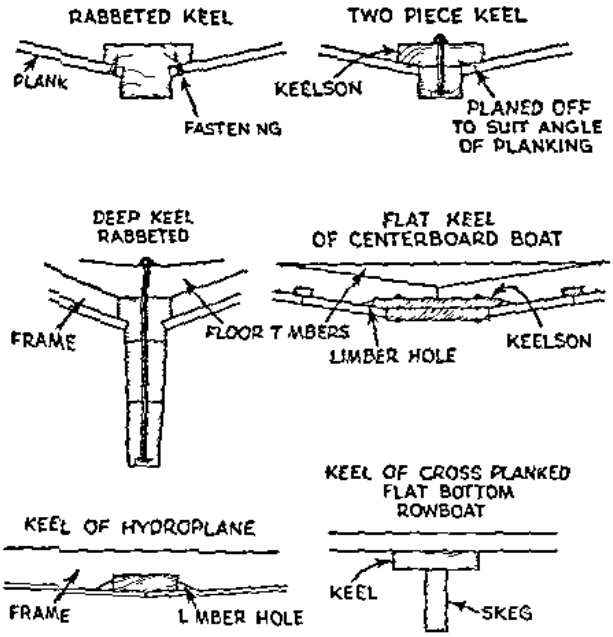
for Boat Builders

such bolts should be a driven fit with the nuts on the inside and the heads countersunk on the outside so that they can be covered with plastic or with a wood plug soaked in paint or marine glue

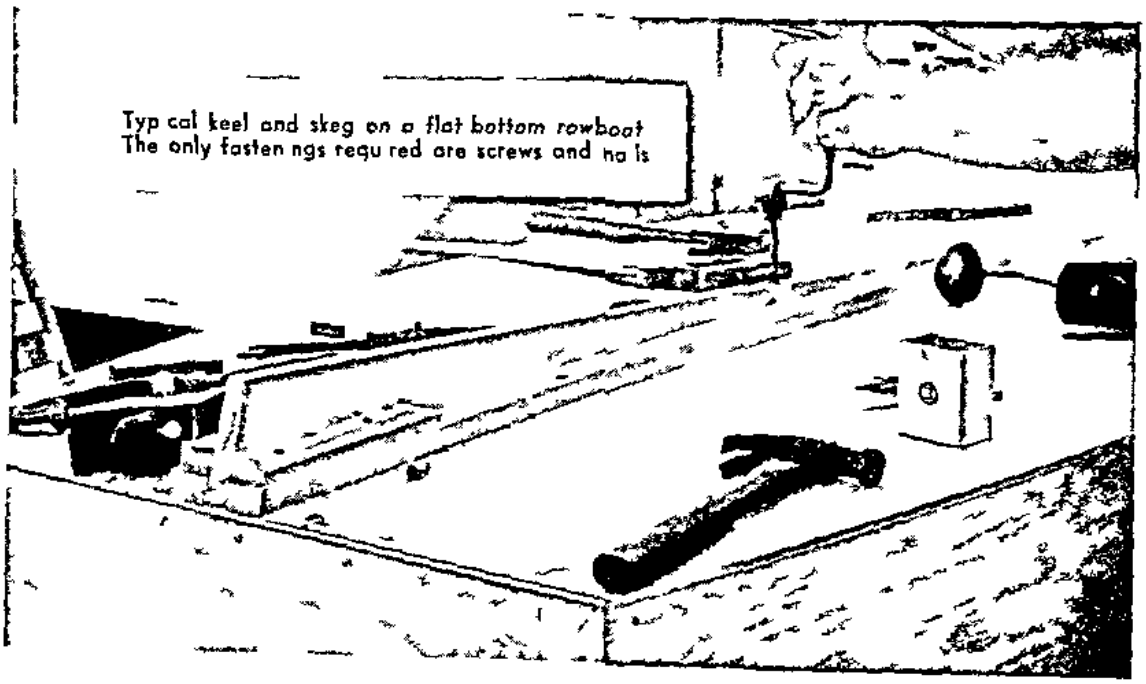
On small boats with a flat keel there may be added a skeg toward the stern The skeg often takes the place of a deeper keel in helping to maintain a straight course while rowing In large inboard boats a similar addition to the keel is known as deadwood it protects the shaft and propeller The skeg or dead wood is fastened to the keel proper with long bolts or galvanized rod or in very small boats with screws only

An upright piece at the end of the keel skeg or deadwood called a stern post is used in many types of boats to brace the skeg or with an inboard as a point of attachment for the stern bearing

The subject of next month's article is the use of resin bonded marine plywood which is the greatest single contribution yet made to help amateurs build better boats This series of articles on small boat construction is intended to supplement the plans presented from time to time for POPULAR SCIENCE *boats The subjects so far covered are Stem Construction (P S M Oct 39 p 175), "Reading Boat Blueprints' (Nov '39 p 203) 'Boat Planking Hints' (Dec '39, p 174), Setting Up the Frame' (Jan '40, p 194), and 'Replanking a Flat Bottomed Rowboat (Oct '40 p 183) For sails, see July 39 p 160 and May 40, p 176*



Here are the ch ef types of keels used on small boats Two p ece keels are well su ted to amateur construct on



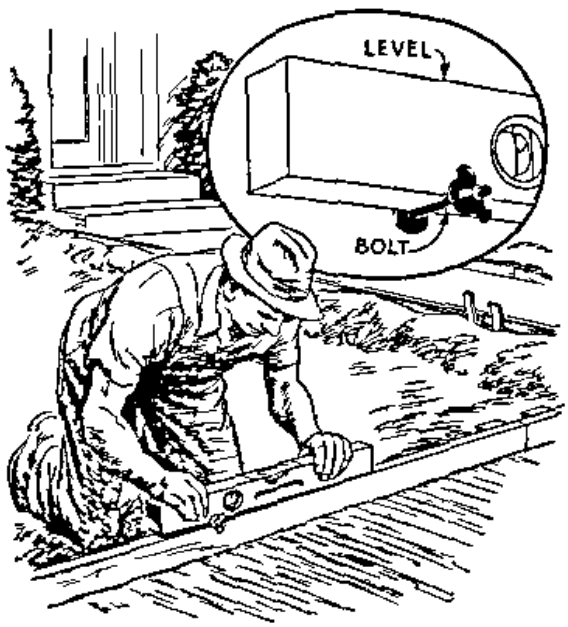


Fishing-Rod Rack Suspended from Picture Molding

A FISHING ROD rack of any desired size can be made at trifling expense from two pieces of scrap wood and two ordinary picture hooks of the type shown above The rack is hung from the picture molding and the rods are supported by inserting their tips in the slots which must be cut to suit the diameters —W SCHEDLBAUER

Bolt Adjusts Slope of Level

TO ADJUST his spirit level for determining the slope of cement walks one contractor uses a bolt and thumb nut It is fastened beneath the level at any point necessary to give the required angle In this way the forms are quickly and accurately adjusted



Section of Old Auto Casing Serves as Gate Latch

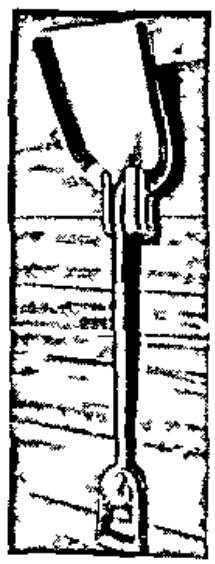
THIS practical latch for a farm gate may be made by cutting a notch in one side of a short section of a discarded auto casing and nailing it near the top of the gatepost as illustrated below —G E H



Method of cutting piece of tire casing and attaching it to a fence post

Hanger on Wall Keeps a Shovel Out of the Way

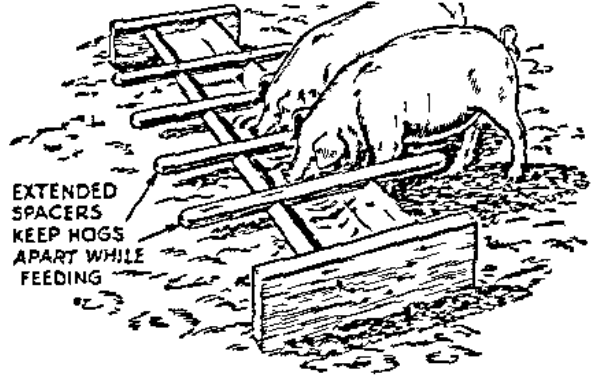
ANOTHER use for an old tire casing is as a holder for shovels and similar tools Cut a section 6 long and with a sharp knife make a slot about 2½ long in each of the side walls Nail this section on the wall with the slot openings facing upward Place the blade of the shovel in the slots —S LONGIN



Soldering Copper Kept Hot for Work in Cold Weather

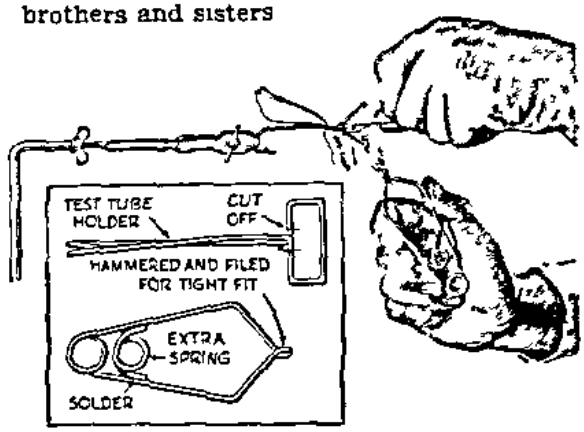
SOLDERING outside in cold or rainy weather sometimes has to be done under conditions that make the continued heating of the soldering copper almost impossible In such cases, heat the copper inside some nearby building to a slightly greater degree than usual and plunge it into a tin can filled with ashes, sand, or dry earth. It can then be carried to the work without losing a great deal of its heat.—ELMER E. BERGMAN





Long Bars Across Hog Trough Prevent Fighting at Meals

ENLARGING upon the idea of placing dividers in hog troughs to prevent fighting at meal times, some stockmen have gone further and extended the spacers so that each animal is confined to his own section and cannot crowd sidewise to shut out his hungry brothers and sisters



Plants Protected from Frost by Self-Anchoring Covers

ROCKS or other weights are not needed to hold tin cans over small plants for protection from frost if the open ends of the cans are clipped to provide a serrated edge A mere tap on top of the can will drive it into the soil If the admission of some air to the plant is desired do not force the teeth of the cans all the way into the ground.



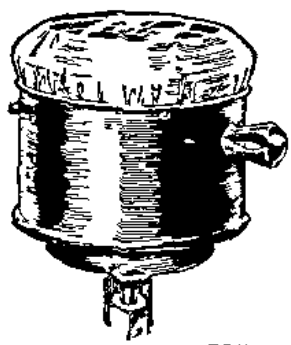
Test-Tube Holder Converted into Fly-Tying Pliers

TO TIE flies expertly, it is necessary to have a good pair of hackle pliers These can be made from a wire test-tube holder, obtainable from any chemical supply house for about ten cents Cut off the holder where indicated then hammer and file the ends to fit smoothly and tightly together. To increase the tension, an extra spring is then added as shown.—LEROY NOYES.

Oiled-Silk Caps for Oilstove Burners

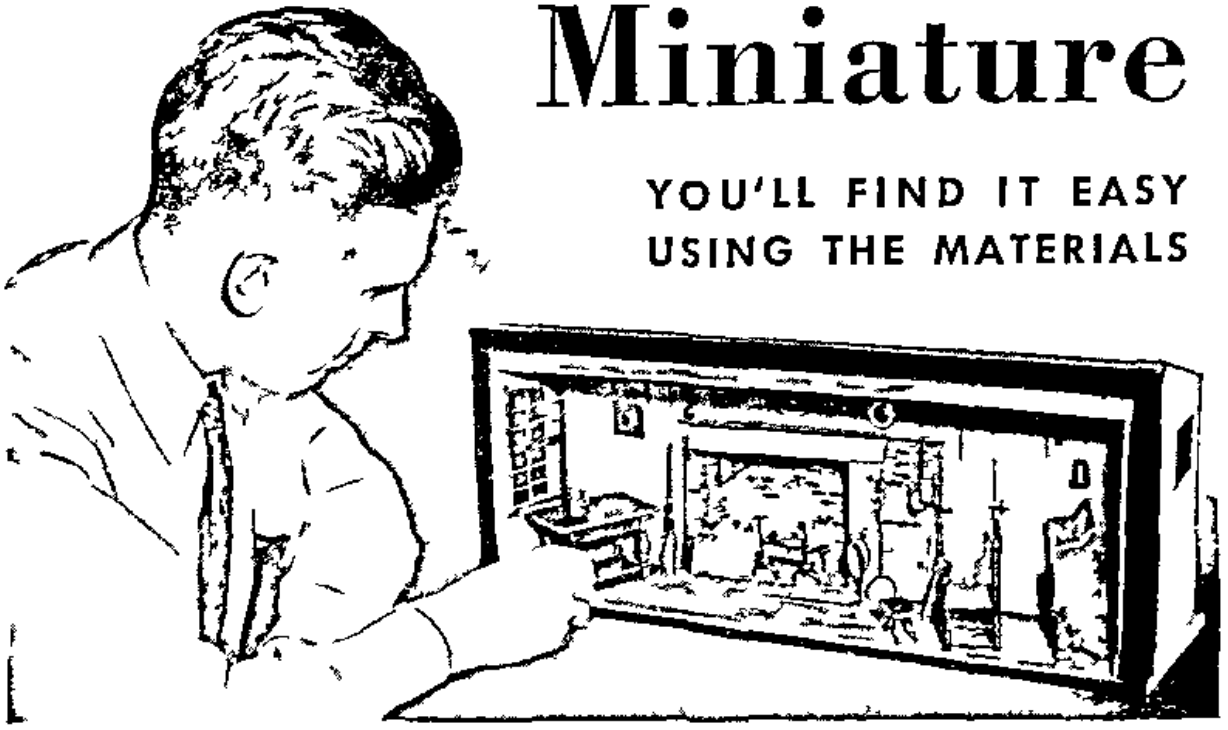
OILSTOVES, especially those used in summer kitchens, cabins, or *camps, are often left unused for long periods,* during which they may become very dusty As a result, they burn poorly when first *lighted, filling the room with smoke*

This difficulty can be prevented by slipping oiled silk covers over *the top of the burners when they are not being* used The covers will prevent water, dust, and food particles from falling on the *kindlers, thus keeping them clean for* instant use —*E. H.*

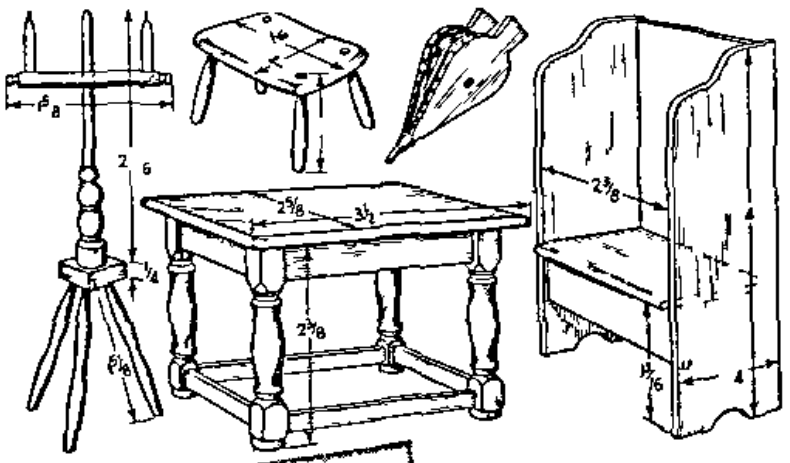


Miniature

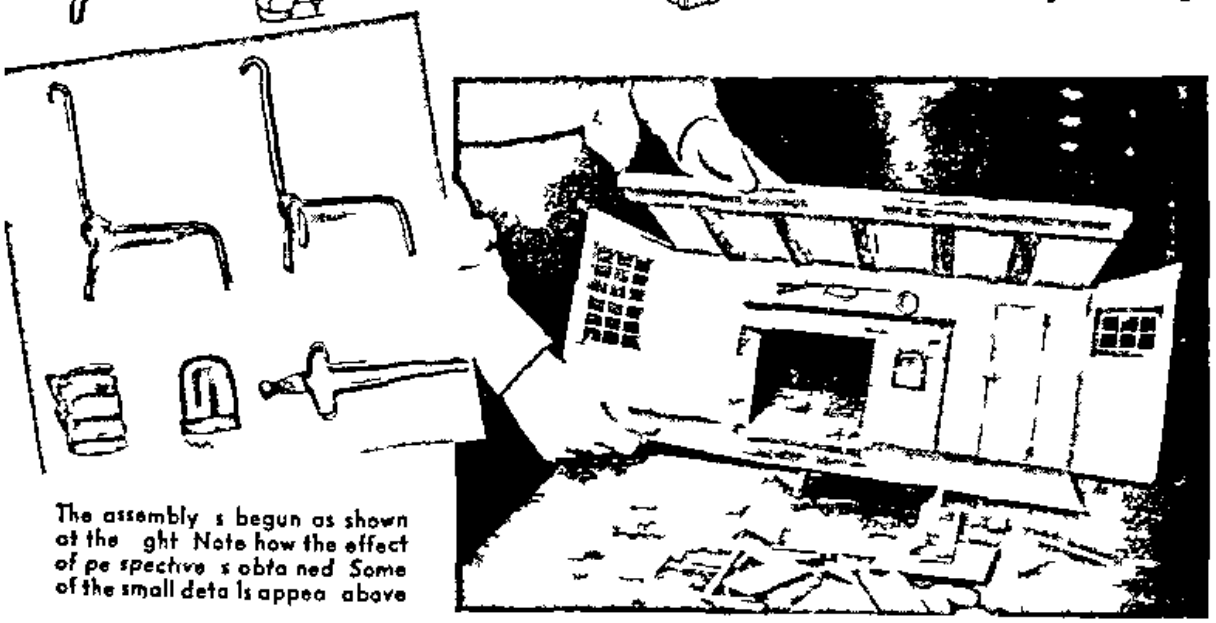
YOU'LL FIND IT EASY USING THE MATERIALS



A though s mple to const uct th s room s an excellent l ttle d o ama—colorful deco at ve authent c



EARLY American home life centered in the room used as both kitchen and living room The huge fireplace served for heat ng as well as cooking A long crane mounted on one s de held several pots for general cook ing and a Dutch oven on the other s de was used for bak ing Frying was done with long handled pans The fur niture was simple a large



The assembly s begun as shown at the ght Note how the effect of pe spective s obta ned Some of the small deta ls appea above

Colonial Kitchen

TO MATCH THIS BEAUTIFUL MODEL BY IN OUR NEW DIORAMA CONSTRUCTION KIT

table slat back chairs and a settle were the main pieces The soft illumination of candle racks and wall brackets supplemented the firelight at night

To re create this picturesque scene in miniature takes but a few hours with a new inexpensive construction kit POPULAR SCIENCE MONTHLY is offering to those of its readers who wish to take up the hobby of building small dioramas as outlined in the article Scenes in Miniature published last month (P S M. Oct 40 p 198)

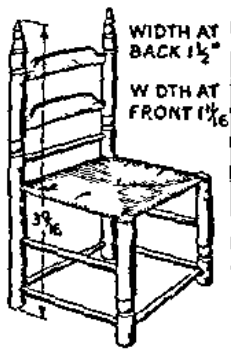
The complete kit with detailed instructions and drawings costs only two dollars It will insure the success and artistic quality of your first attempt at this work and also teach you more about the construction of realistic and beautiful dioramas than you could hope to learn in reading many articles on the subject. The kit is illustrated on page 224 In ordering it please use the coupon on page 226

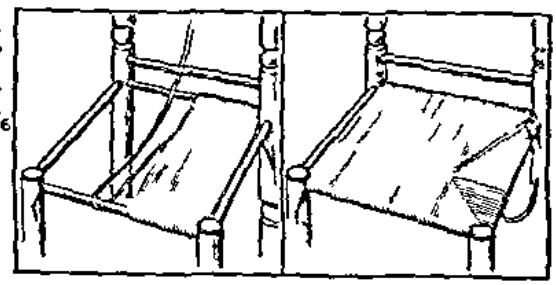
The room is an Early Colonial kitchen of the type most commonly in use between 1730 and 1780 A scale of 1" equals 1 was used in designing the model which is about 21" long 7" high and 5" deep

Walls floor ceiling and fireplace are printed in four colors on heavy cardboard All flat parts of the furniture have been marked on plywood and can easily be cut out The turned parts come already shaped Such accessories as the metal pans and irons and shovel are die cast and require merely to be painted

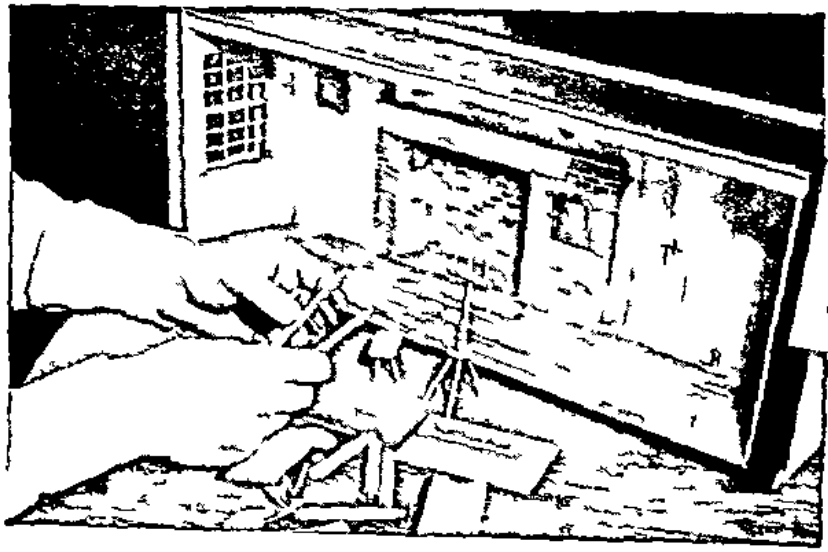
Erecting the model is a pastime the entire family can enjoy Father and son can cut out and assemble the furniture Mother and daughter can help install the fixtures as well as crochet tiny rugs for the floor and make curtains for the windows

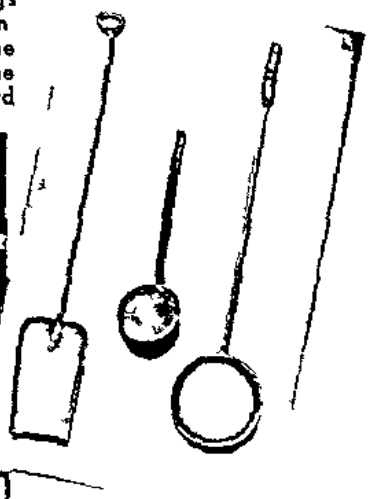
The first step is to fold the room into



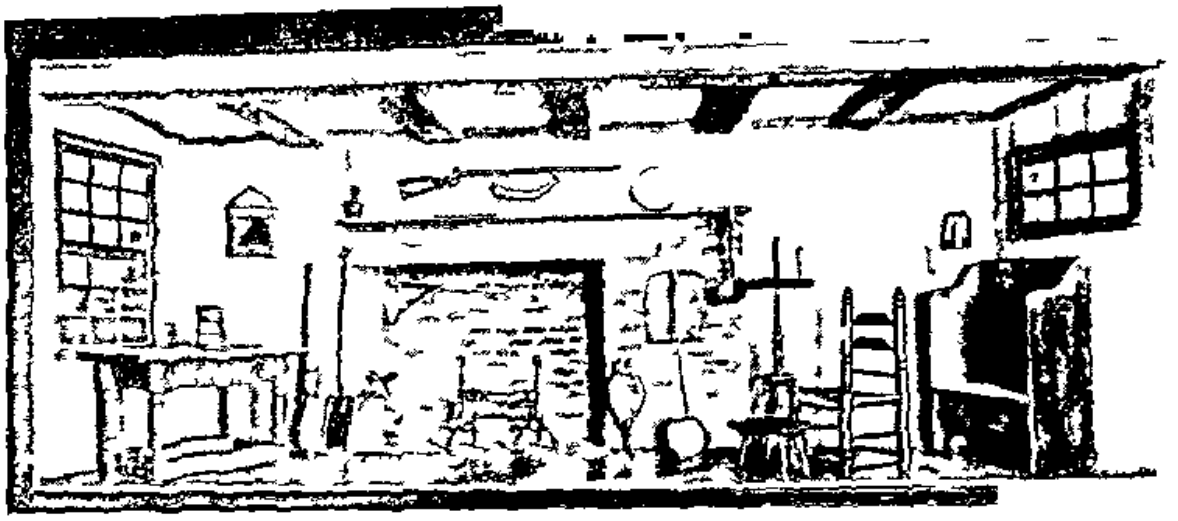


The chair legs are minute turnings When the frame has been glued together the "rush seat is applied by using cord





The small metal parts require no work except painting but the furniture pieces are scale models that have to be built up piece by piece



Constructed on a scale of 1 equals 1 the model s approx mately 21 long 7 h gh and 5 deep

shape and glue the flaps where sections must be *joined* Then *install* the front beam A framework of wood may be added to give additional strength, if desired but the room will remain rigid if the flaps are glued *securely*

Now jig saw the flat parts of the furni ture to shape and cut the *dowels to the* correct lengths Drill 3/32" holes as in dicated on the drawings accompanying *the* kit. Sand all pieces with 3/0 paper Rub on the wax finish and polish with a *soft cloth* being careful no wax is applied to surfaces to be glued Two applications are *sufficient* Assemble the pieces with glue

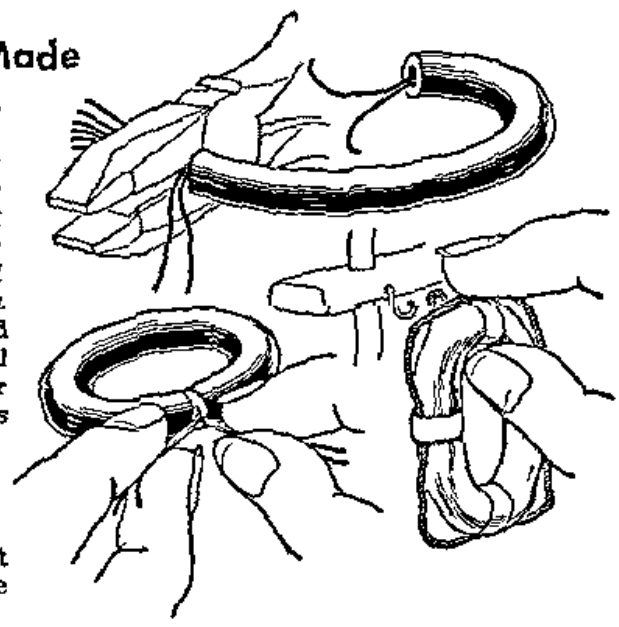
An imitation rush bottom can *be given* the chair by winding cord around the front and back rails then weaving it *sideways* with the aid of a needle as shown Candles are made from round toothpicks about ½" long Dip them in white enamel and before it dries place about ⅛" of black thread on the top of each for a *wick*

Old sandpaper forms the flexible part of the bellows Scrape off the sand cut a piece about ¾" by 3" and fold and glue it between the two wooden sides Heavy black *thread* binds the sides and nozzle (piece of dowel) together Coat with shellac

Glue the chromium plated mirror to the back of the printed cardboard frame and *insert* a short string through the top for hanging Glue the transparent cellulose *sheets* on the outside of the windows Fasten the rifle and powder horn above the *mantelpiece* with thin wire Paint andirons shovel tongs crane kettle and pans black *Hold* the crane in position with thin wire Glue the fireplace to the back of the room *and arrange* the furniture and utensils

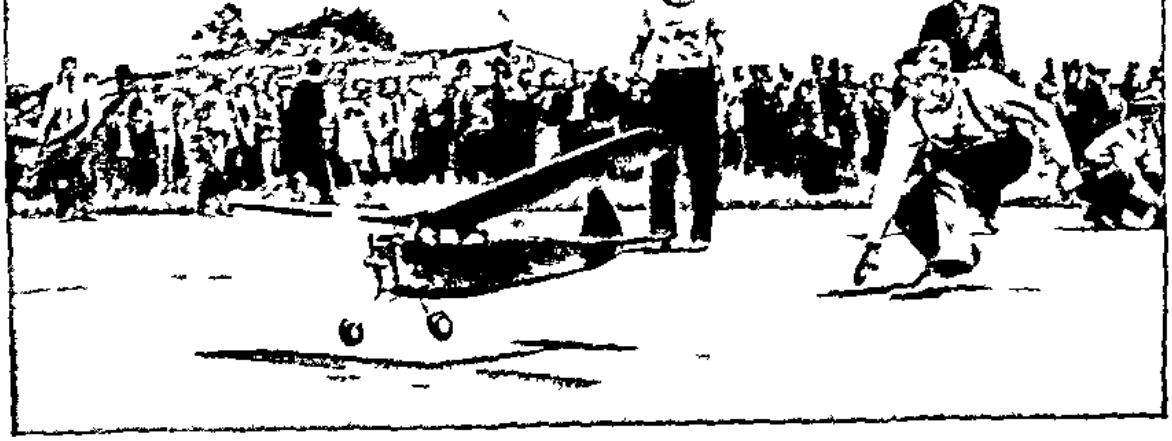
Small Ship-Model Life Buoys Made from Rubber-Covered Wire

LIFE buoys for model ships may be made from flexible rubber covered wire of the correct scale size Bare the ends leaving sufficient insulation between to form the buoy and cut away all but two strands of wire at each end. Then bring the two *ends* around twist the wires together and bend into a loop For the rope twist several strands of écru colored silk thread together and fasten on the buoy with narrow *strips* of adhesive tape Paint the completed as sembly white —PAUL H. SMITH



• • •

SMALL model parts can often be found at a ten-cent jewelry counter Those include chains and sometimes even good anchors



Gas-Model Plane Parachute

INSURES CRASHPROOF LANDINGS

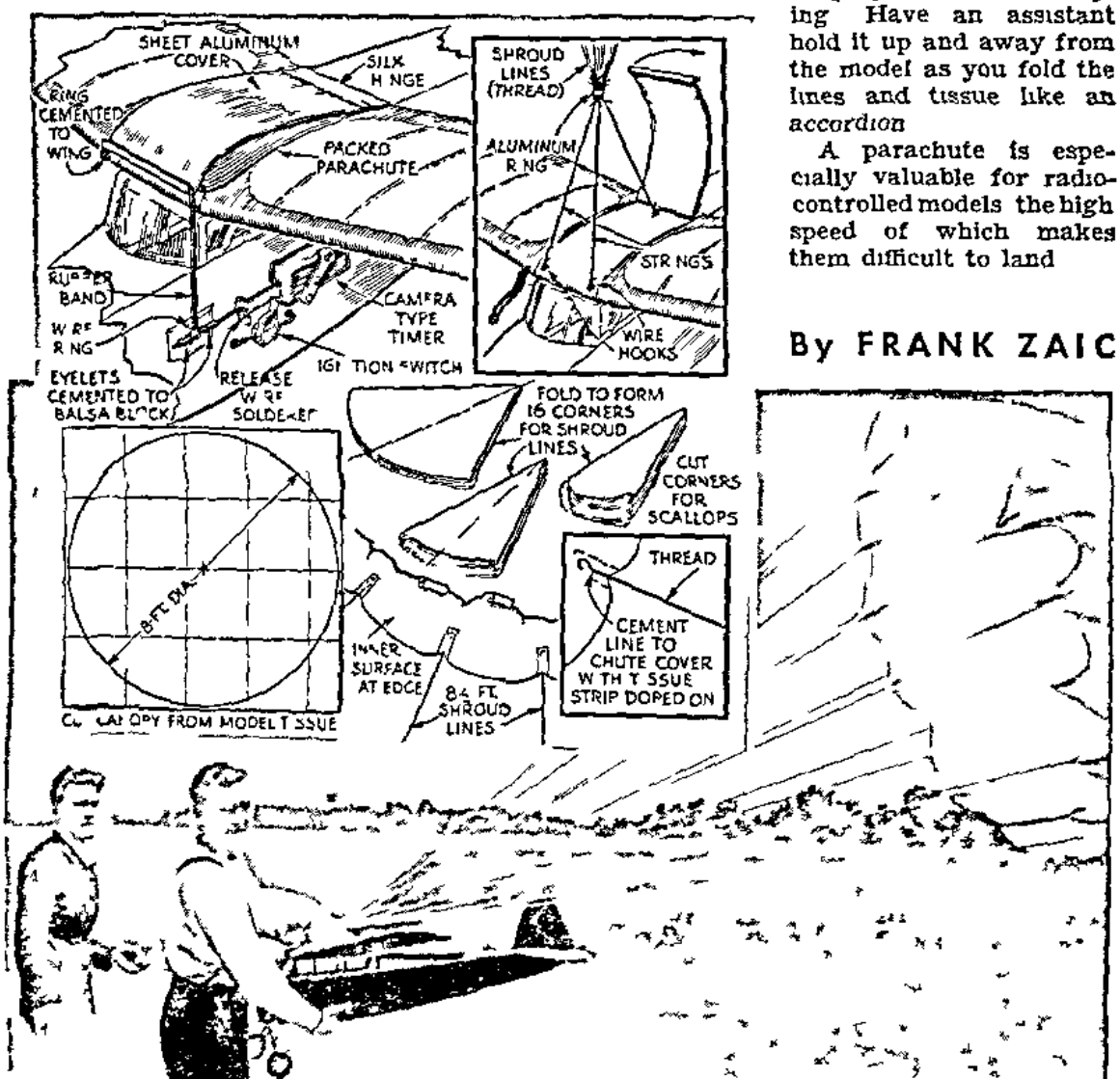
HERE is an automatic parachute attachment for lowering a gas model plane safely to the ground. It was developed by Bob Horton, president of the Syracuse (N. Y.) Model Airplane Club.

As soon as the motor stops, a timer releases a rubber band which in turn releases the aluminum flap under which the 'chute is packed. The wind pressure blows the flap back, and the chute pops out and up to unfold and bring the model down gently.

The chute weighs about 7 oz. and is large enough to support 3 lb. or more. It is folded for use in the same way in which it is prepared for scalloping. Have an assistant hold it up and away from the model as you fold the lines and tissue like an *accordion*.

A parachute is especially valuable for radio-controlled models, the high speed of which makes them difficult to land.

By FRANK ZAIC

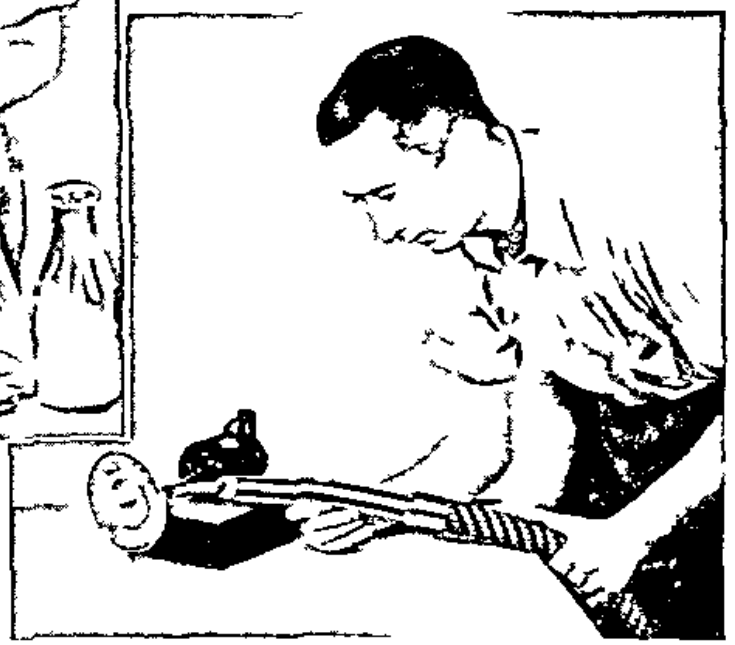


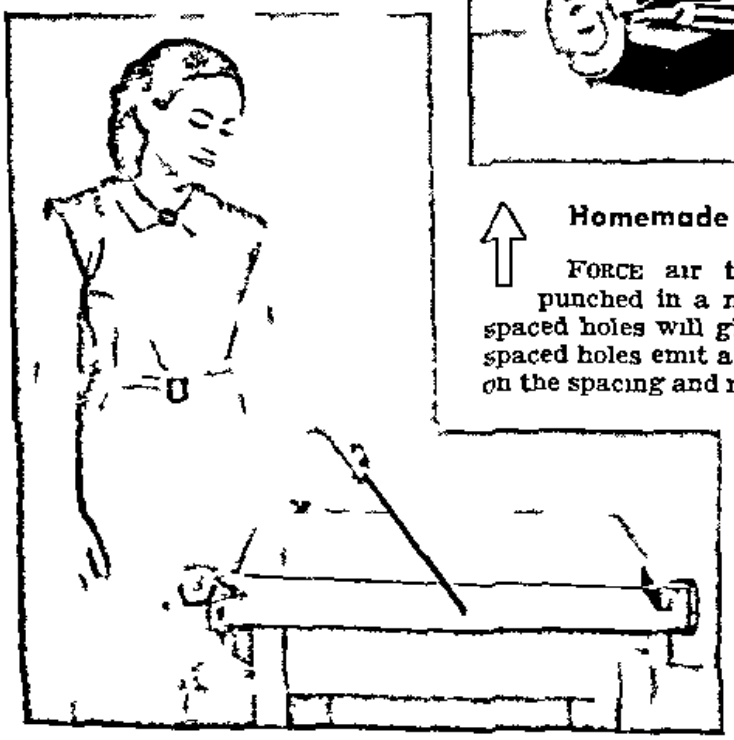
HOW MUSIC COMES



Milk Bottles Serve as Organ Pipes

BLOWING across one end of an organ pipe sets its column of air vibrating producing a musical tone In long pipes the vibrations are of long wave length and the tone is therefore low the converse is true of short pipes This may be demonstrated with the milk bottle organ shown for which the bottles serve as pipes and an attachment hose of a vacuum cleaner supplies a blast of air By partially filling the bottles with water the height of the air columns may be adjusted for pitch.





Homemade Siren Produces Musical Tone

FORCE air through a circle of small holes punched in a motor-driven tin disk. Irregularly spaced holes will give only a confused noise Evenly spaced holes emit a musical tone whose pitch depends on the spacing and motor speed

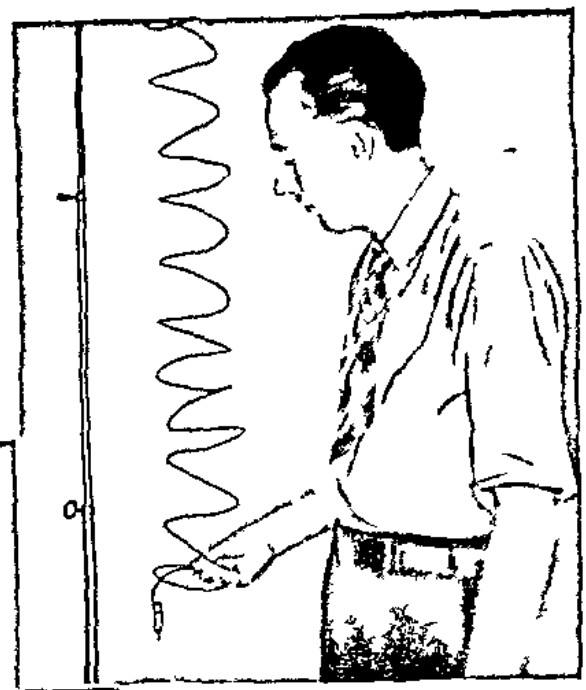
Weighted Wire Shows How String Instruments Work

FASTEN a steel wire at one end, and weight the other after passing it over a pulley Its musical pitch when bowed or plucked may be raised by increasing the tension on shortening the string or substituting a thinner wire

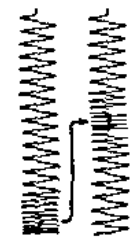
FROM SOUND WAVES

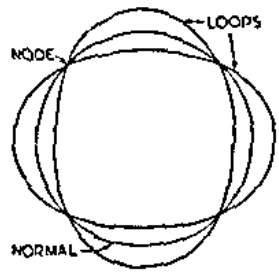
Coil Spring Illustrates Sound Waves

WHAT we hear as sound is a succession of waves of compression and rarefaction passing through the air from the source to the ear A simple weighted spring demonstrates this mechanically Squeeze together two or three of the lower turns and then release the spring A wave of compression will travel up and down the spring until the original energy has all been expended One of the small diagrams below the photograph illustrates the movement of the wave along the spring



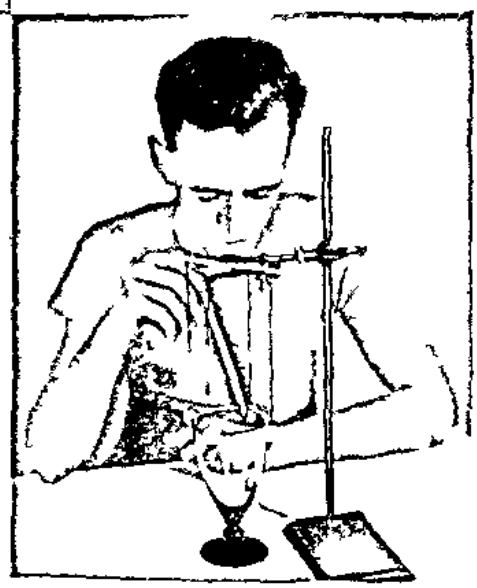






Easy Test for Sound-Reflecting Qualities

TO TEST the sound absorbing or reflecting properties of various materials place a watch in an open cardboard tube insulated from a table with cloth or cotton Set a cardboard sheet at a forty five degree angle near by Listen through a tube as shown Bits of cloth laid over the cardboard will diminish the loudness



Goblet Vibrates Just Like a Ringing Bell

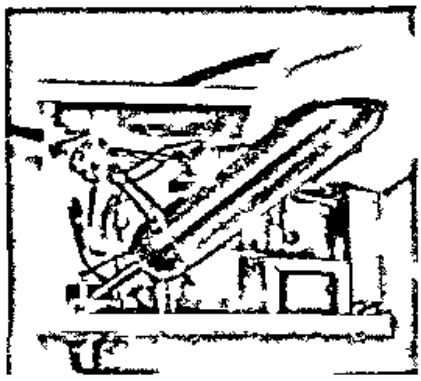
WHEN a bell is struck by its clapper its rim is distorted into an elliptical shape from which it springs back through the circular to another ellipse with its longer axis at right angles to the first. You can see this action by suspending four glass marbles in contact with the outside of a goblet and striking the inside with a pencil

WHAT'S NEW IN THE

Signal Tracer Quickly Locates Troubles in Receivers

CONTAINING a vacuum tube and volume control a new signal tracer quickly locates the seat of trouble anywhere in a radio receiver All servicing tests are said to be possible with the unit. The tester is connected to the circuit, and the set is turned on. A test prod at one end then locates the trouble when the tester causes the set to operate properly





The tester in use With its cover removed left the radio tube is visible

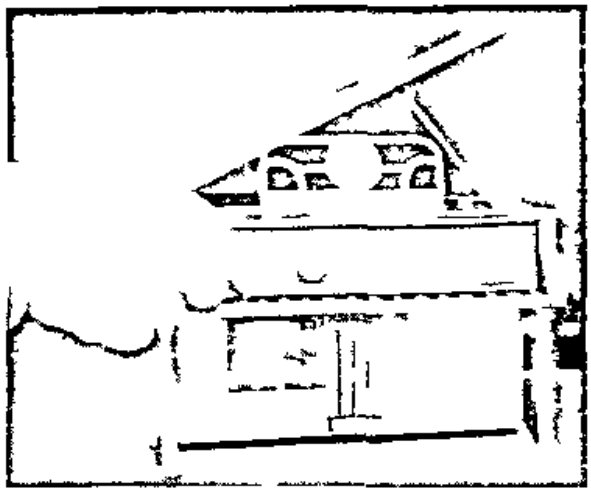
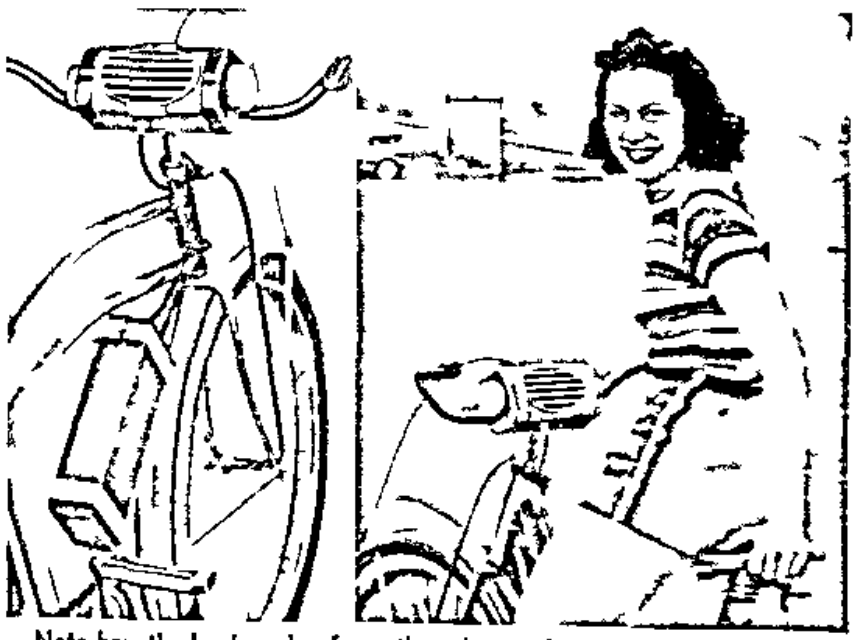


Table-Model Set Masquerades As Midget Grand Piano

AN ATTRACTIVE miniature of a grand piano recently introduced houses a midget radio receiver As shown above the tuning knob and switch are on the panel directly above the keyboard, while the speaker grille and tuning dial are below The signature of the treble clef decorates the speaker grille of the receiver

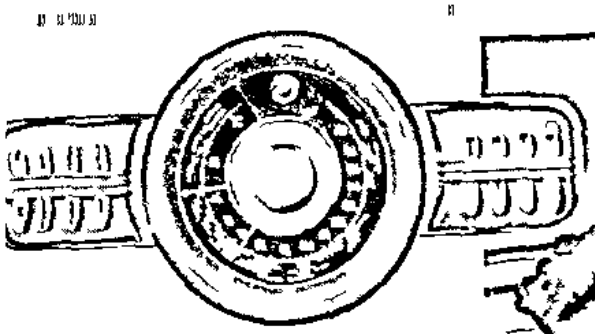
Loudspeaker Radio for Bikes Rides on the Handlebars

WITH a new battery set designed to fit atop the handlebars bicycle enthusiasts may now listen to their favorite programs no matter where they happen to be pedaling As shown in the illustrations at the right, the set has convenient tuning and volume knobs at the sides and a separate battery box that clamps to the bicycle frame An antenna attaches to the tip of the front fender and curves back to the set. The three tube receiver the loudspeaker of which faces the rider measures only 3¼" by 4¼" by 8".



Note how the loudspeaker faces the rider on this new bicycle radio set

WORLD OF RADIO

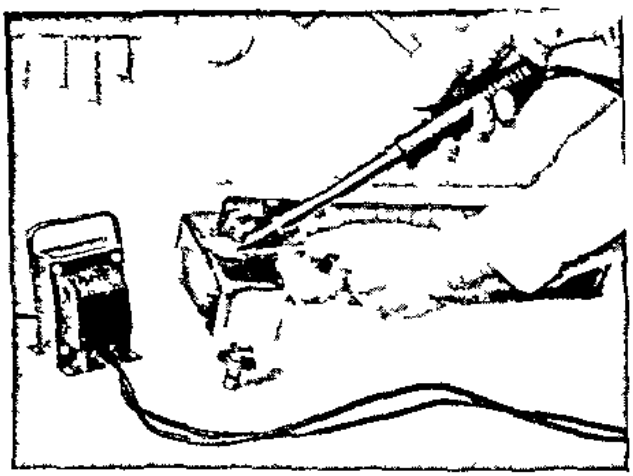


Push-Buttons Control Wide Tonal Range

AS MANY as sixty four tone combinations may be selected at will by manipulating push buttons on a new radio now available. By enabling the operator to emphasize both bass and treble vocal or instrumental tones simultaneously just about any tone effect can be obtained. The tone control push buttons are conveniently grouped at one side of the tuning dial as shown in the smaller photo above.



Buttons give the receiver sixty four different tone settings

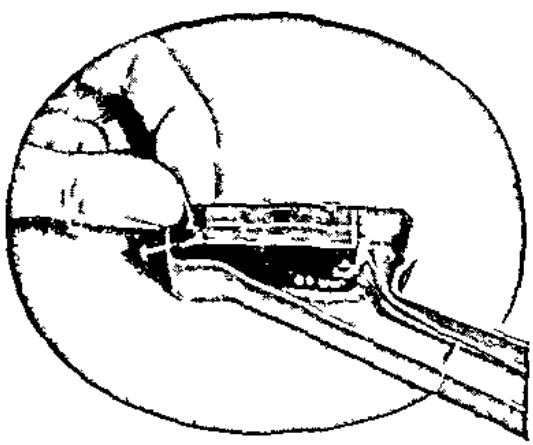


New Lightweight Soldering Iron

WIRE heating elements and heavy tips for holding the heat are eliminated in a new soldering iron for radio-set builders. The tip contains a special carbon electrode element that is said to bring it to soldering temperature in less than a minute. Power regulated by a convenient thumb switch is fed through a compact transformer.

Phonograph Crystal Unit, Like Coffee, Now Dated

JUST as coffee companies milk distributors and others date their products to show their freshness a maker of crystal units for electric phonograph pick ups is now dating his products. Purchasers can thus tell at a glance just when the crystal unit was assembled.

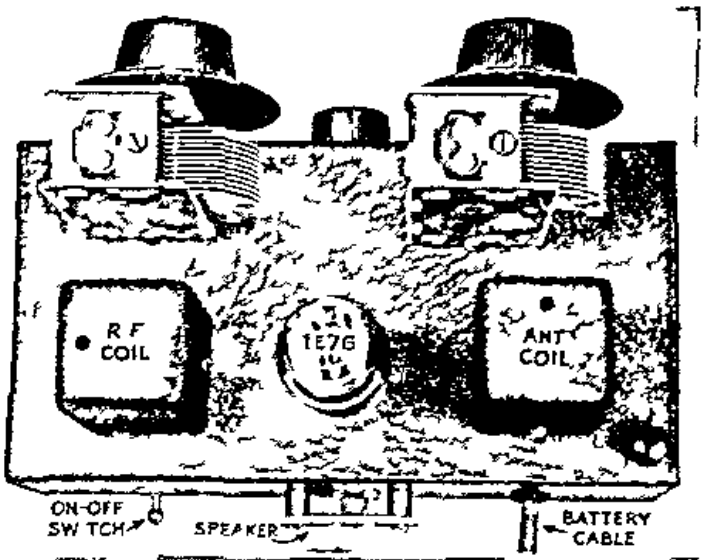


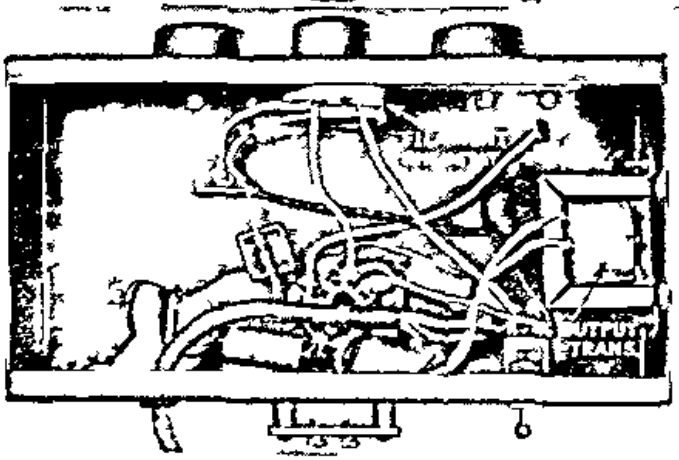
One-Tube Set Gives

WITHOUT the use of a tricky reflex circuit or hard to get parts this one tube tuned radio frequency set will give full loudspeaker results on all local stations when a good outdoor antenna is used Within ten miles of local stations even an indoor antenna can be used and its selectivity is such that powerful local stations only 30 kilocycles apart can be easily separated

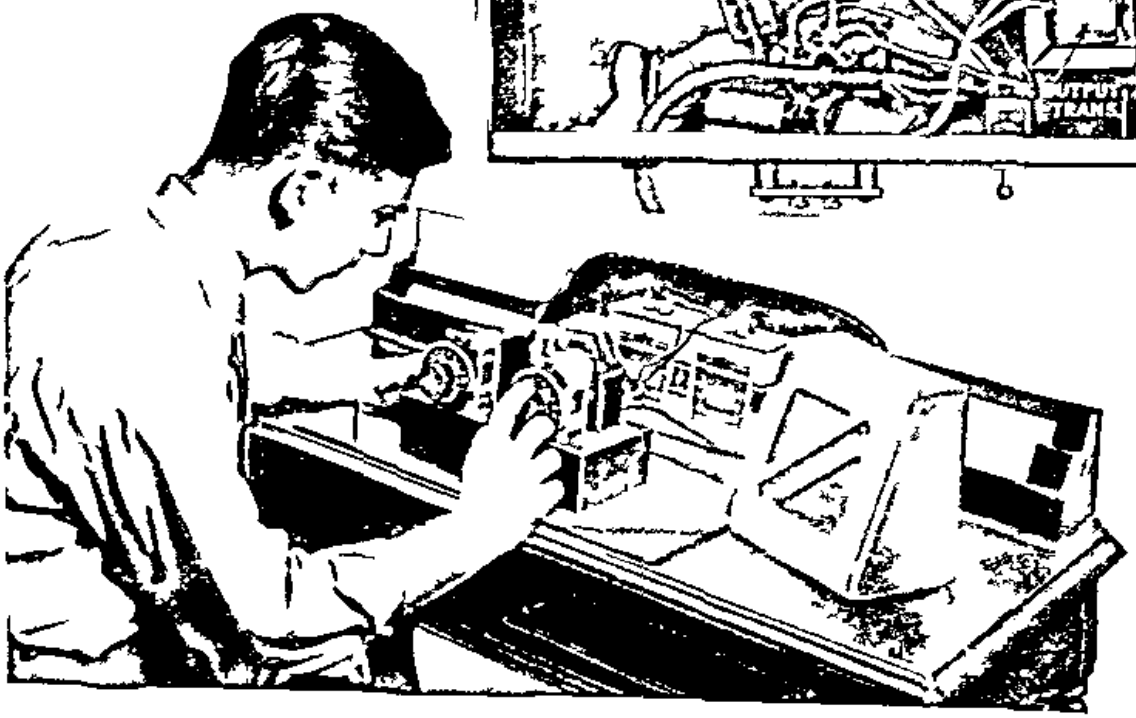
This remarkable performance is due chiefly to the fact that iron core coils are used in the antenna and radio-frequency stages Also in order to get the most out of each stage and to allow greater flexibility of control two separate tuning condensers are used

A double pentode power amplifier (1E7G) is the single tube used One section serves as the radio-frequency amplifier while the other provides the detector and output stages of the receiver Grid leak detection is used on the second tube and its plate is connected directly to the speaker without any additional audio-frequency amplification. Sufficient power is obtained with this hook up to work a 6"





These views of the top and underside of the chassis will serve as a guide in placing the various parts Below the set in operation Note the batteries and separate speaker unit



Loudspeaker Volume

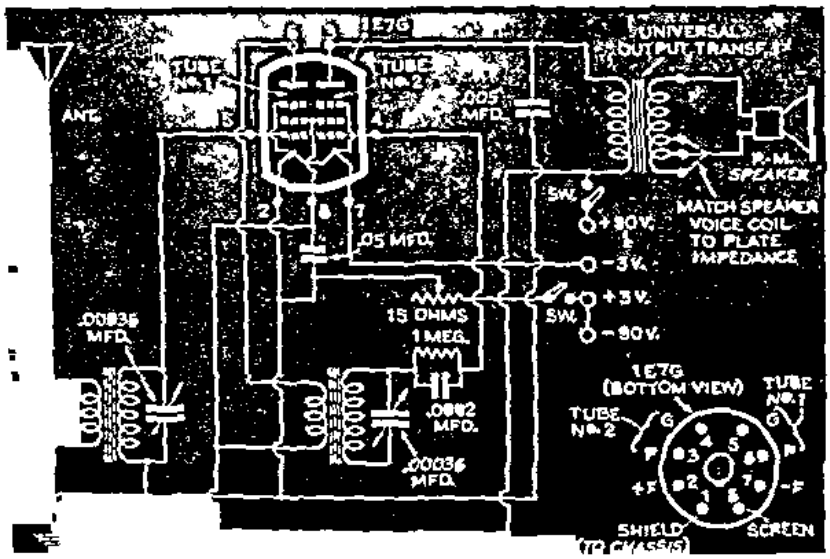
speaker without the use of any regeneration

In wiring the set care must be taken to connect the positive lead of the 'A' battery, and not the minus, as is usually done, to the chassis This is an important point as the set will not operate properly if the A leads are reversed A double-pole single throw switch serves to break both the A and "B supplies and can be mounted on the rear of the chassis The switch can be either the toggle or rotary type

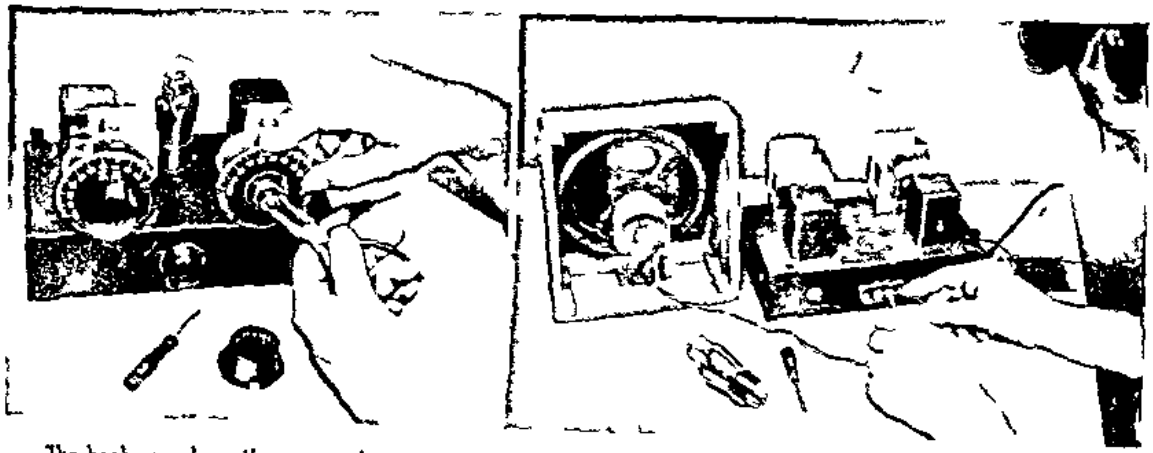
The speaker is separate from the chassis and is mounted in a wall type baffle simi lar to those used in public address paging systems The baffle has a sloping front designed to take a 6 speaker The universal output transformer, necessary for matching the voice coil of the speaker to the load resistance of the tube (or plate impedance, as it is sometimes called), can be mounted under the receiver chassis The load resistance of each section of the 1E7G is 16,000 ohms and an instruction sheet inclosed with each transformer will indicate the taps to use to match the speaker to that load resistance The taps are placed on the secondary winding of the transformer.

When wiring the 15-ohm rheostat, which serves as a volume control by decreasing the filament voltage, be sure to connect the resistance winding to the 3-volt battery Many times the moving arm is connected internally to the shaft and if this is the case it will be grounded automatically to the chassis In cases where the arm is insulated, it will not make any difference which way the rheostat is wired

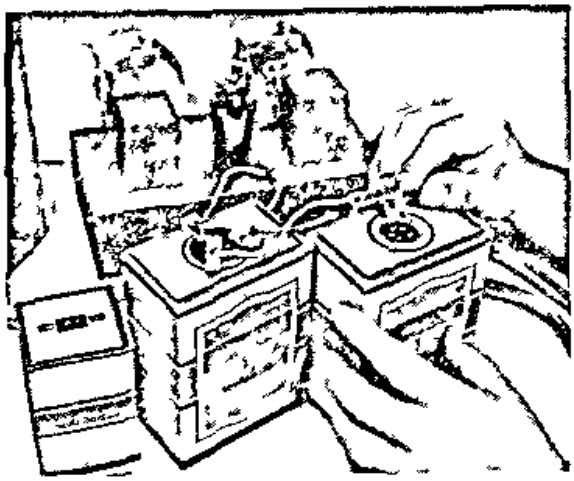
Since this 15-ohm variable resistance also serves to cut down the 3-volt 'A battery supply to the 2-volt maximum required by the filament of the tube, a mark should be made on the front panel just above the rheostat knob to indicate the safe 2-volt limit beyond which the



With only one tube the circuit wiring is easy even for a beginner



The knobs used on the original receiver have no set screws A nut, concealed under a removable cap holds each on its shaft The photo at the right shows how the loudspeaker is connected



Three new-style batteries are used to power the receiver The plug in type connectors save time

rheostat knob should never under any circumstances be turned

In tuning the set, remember that both tuning condensers must be operated. The two readings will be just about the same, provided the dials are mounted on their shafts in the same relation As a matter of fact these two condensers can be ganged if desired but the double control does provide greater flexibility and makes it possible to make minor adjustments in any one condenser in order that maximum volume may be obtained.

No ground is necessary with the circuit, and as pointed out earlier the type of antenna, indoor or outdoor, will depend entirely *on your geographical location with respect* to strong local stations

LIST OF PARTS

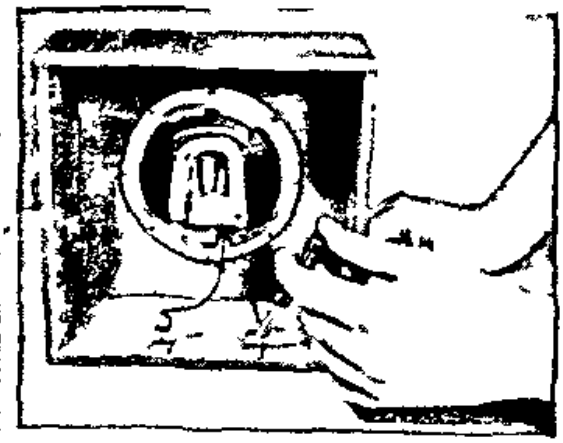
Shielded antenna coil, iron-core
Shielded RF coil, iron-core
Condensers, tuning, two, 00036 mfd.
Condenser, tubular, paper, 05 mfd., 600 v
Condenser, tubular, paper, 005 mfd, 600 v
Condenser, mica, 0002 mfd.
Resistor, carbon, 1 meg, ½ watt.
Rheostat, 15 ohms 4 watts
Miscellaneous Tube (1E7G), octal wafer socket, universal output transformer, chassis (2½" by 5" by 9½"), cabinet (4½" by 7½" by 8½"), two dials, D P S T toggle switch, two 45-volt 'B' batteries, one 3 volt "A" battery, PM speaker, wire, solder, etc

Get Started IN Radio

BY ADDING a half-dozen parts to the *all-electric receiver described last* month as part of this series, you can provide a final stage of amplification For this stage, the power pentode in the 70L7GT tube is used, and with this additional power there will be sufficient volume to operate a loudspeaker The speaker, included in the original list of parts (P S M, Sept. '40, p 196), is a 5" magnetic unit which can be mounted in a small homemade wooden cabinet If you do not wish to go to the trouble of making up a special cabinet, the speaker can be mounted on a small baffle about a foot square Two Fahnestock clips can be used to connect the speaker to the set. These are mounted just inside the cabi-

ADDITIONAL PARTS

Mica condenser, 002 mfd
Electrolytic condenser, 10 mfd.
Fixed resistor, 150 000 ohm
Fixed resistor, 1 megohm.
Fixed resistor, 600 ohm
Loudspeaker



Two spring cl ps serve as speaker connectors

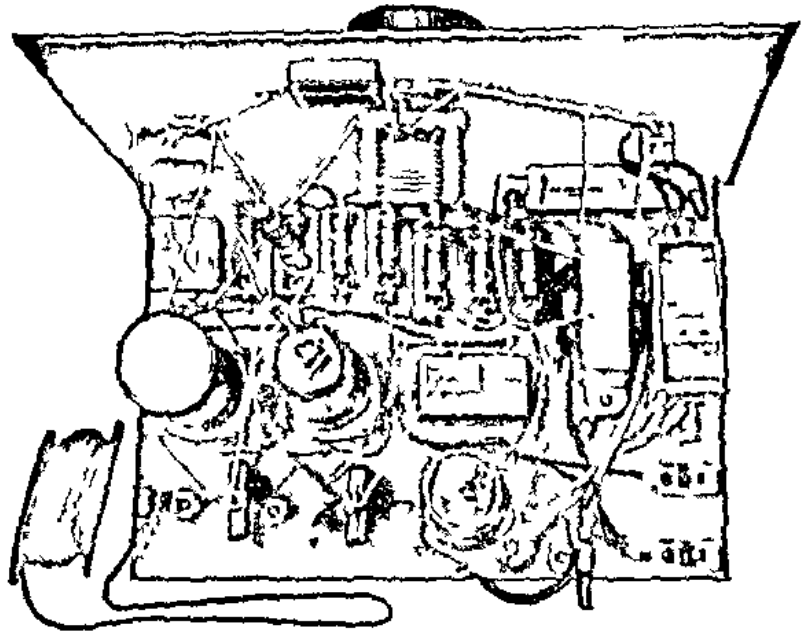
PART III . . . A FOUR-TUBE RECEIVER

net, along the bottom *(see photo)*

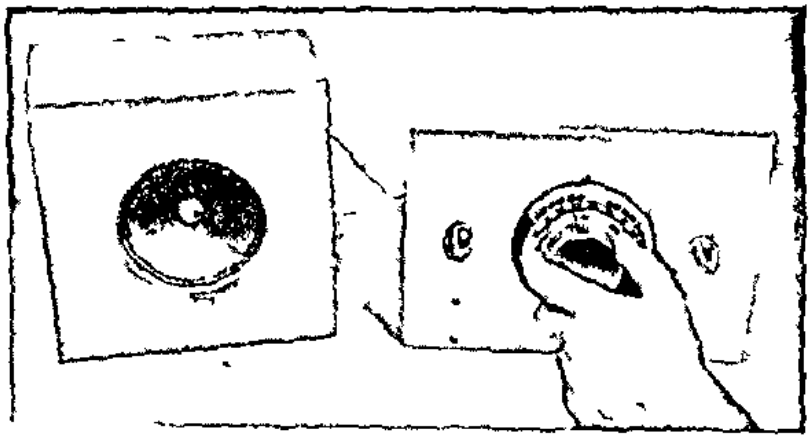
The additional parts required from the original parts list are one *.002-mfd* mica condenser, one 10-mfd electrolytic condenser, and three fixed resistors *(150 000 ohm,* 1 megohm, and 600 ohm)

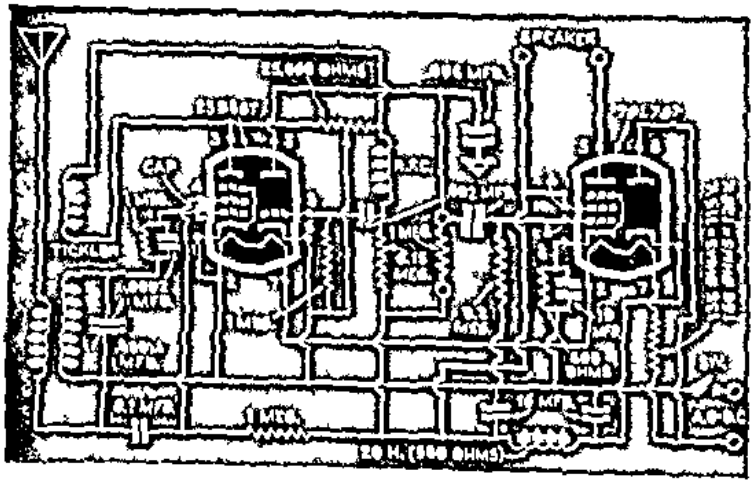
When making the various changes, note that some fixed resistors used originally have been juggled around a bit For instance, the *200 000-ohm resistor* used in the plate circuit of the three-tube circuit has been replaced by a 150 000-ohm resistor and the 200,000-ohm resistor used in the grid circuit of the power pentode (70L7GT). The original 006-mfd paper tubular condenser is used this time as a bypass condenser between the plate of the triode (25B8GT) and the ground *(or chassis)* No ground connection is needed with this "four-tube" circuit

Any type of antenna may be used

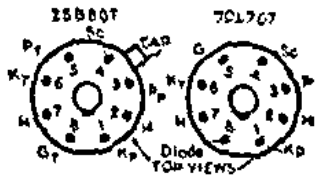


The circuit as it appears wired as a four tube receiver. The antenna wire is coiled at the left. The clips at the right are for the speaker

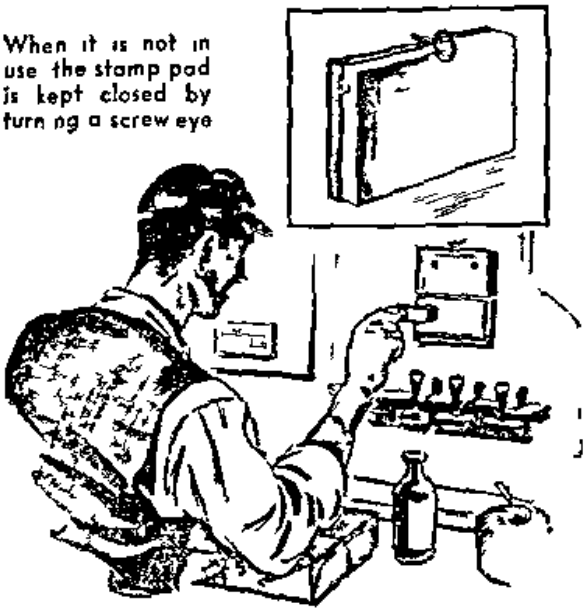




In wiring the circuit be sure to follow the diagram carefully The new portion of the circuit is indicated by the heavy lines. Socket connections are shown below



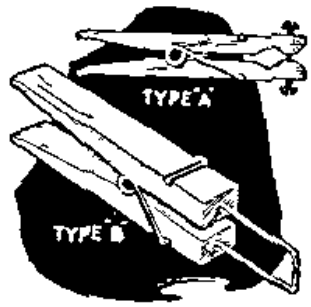
When it is not in use the stamp pad is kept closed by turning a screw eye



Stamp Pad Nailed on Wall Above Shipping Bench

A SHIPPING clerk keeps his stamp pad handy and prevents others from borrowing it by tacking it on the wall above his work bench as shown A screw eye serves as a turn button to hold the box closed

Spring Clothespins Changed into Soldering Clamps



SPRING clamps for holding small metal parts that are to be soldered or brazed can be made from ordinary wooden clothespins For the type shown at *A*, clamp a clothespin in a vise so that the jaws will remain in line and drill a hole slightly smaller than the roundhead screws to be used. After the screws have been inserted, pass a thin file between the points to flatten them

Clamp *B* is used where very small pieces are to be held for soldering It consists of two pieces of wood shaped as shown to take the spring from a spring clothespin The metal jaws are two nails One is flattened on the end and the other is left pointed —J A A

• • •

TO IMITATE frosting on glass mix 6 oz epsom salts in 20 oz warm water and add 2 oz white dextrine, then apply to the glass

Copper Strip Improves Soldering Iron

SOME electric soldering irons have heating elements considerably smaller than the casing An iron of this type will heat more rapidly and be more efficient if a strip of sheet copper is wedged between the element and the casing so as to bring them into firm contact —G S G



REPLACING CANE WEBBING IN CHAIR [*SHIPSHAPE HOME*]

With hammer and chisel remove spline holding old cane in place Clean out groove thoroughly with chisel but be careful not to chip wood

Prepare four or five wooden wedges tapering from ¼" to ⅛" in thickness and about 1" wide Select spline that fits loosely in groove and cut to correct length with a lap of at least ¼" which can be trimmed later Soak woven cane webbing in water from one half to one hour until pliable then lay on seat and trim to exact shape allowing ½" additional around the entire piece Make certain front of seat is parallel with strands of webbing

Drive webbing into groove and hold with wedges first at back then in front and finally at sides Trim off excess webbing with chisel around outer edge in bottom of groove Pour glue (preferably hot cabinetmaker's glue) into groove and insert spline If spline is stiff first steam it or soak in hot water until pliable Drive spline into place with rawhide mallet or use soft wood to protect it from being marred Remove excess glue with wet cloth and let glue set for at least 24 hours

If seat is not tight after drying wet the underside with water and place in sun or near radiator or furnace

POPULAR SCIENCE MONTHLY SHOP DATA FILE



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TONIGHT make a picture taking date with the whole family And for surer results in your snapshots at night under Photofloods load with Kodak Super XX Film about four times as fast as ordinary film You can then from the very first count on indoor snapshots at night that are as clear and brilliant as those you have been getting outdoors in the sun

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Highly effective—three quarts are equivalent to approximately four quarts of ordinary alcohol. Contains a special anti-rust ingredient that protects the cooling system

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HINTS ON BATTERY CARE

It's not the cold weather that ruins batteries

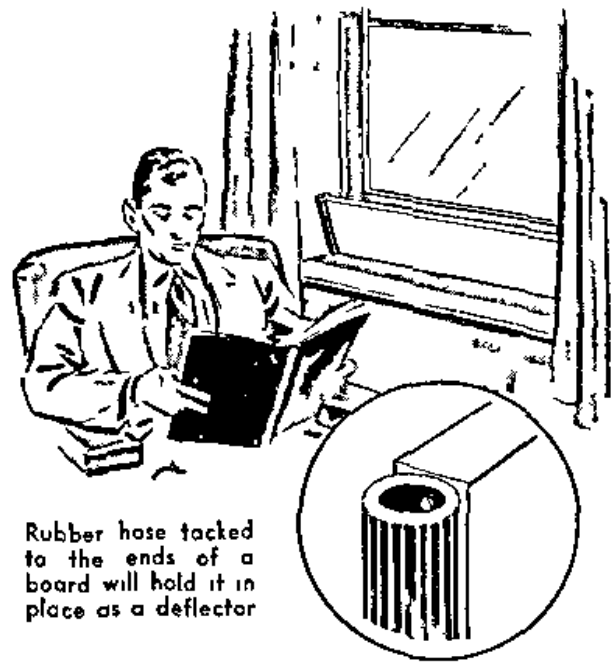


Winter starting failures are often the result of injuries your battery received during hot weather. Heat speeds up the chemical action of your battery—causes the water to evaporate more rapidly—increases the danger of buckled plates and charred insulators. Let your Willard Dealer make sure that the "wear and tear" of summer driving hasn't harmed your battery—see him NOW.

SEE OPPOSITE PAGE...

Willard

YOUR ASSURANCE OF QUALITY



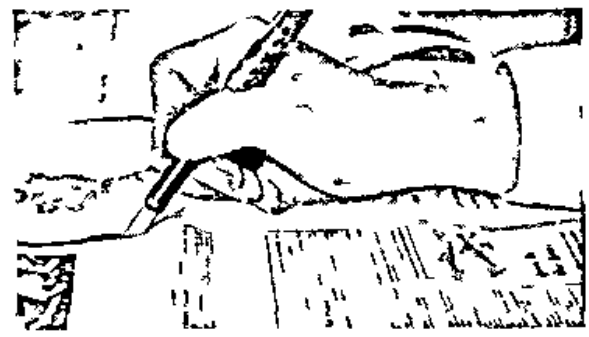
Rubber hose tacked to the ends of a board will hold it in place as a deflector

Draft Deflector Is Wedged Between Window Jambs

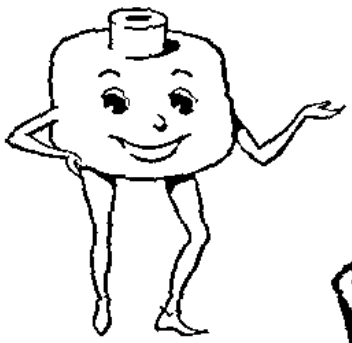
WHEN a board is used to deflect the direct draft from a partly opened window, you can fasten it securely in place and also remove it without the least difficulty by tacking a length of rubber hose to each end as shown. The shield will then wedge firmly between the window jambs on each side and stay at any desired angle.

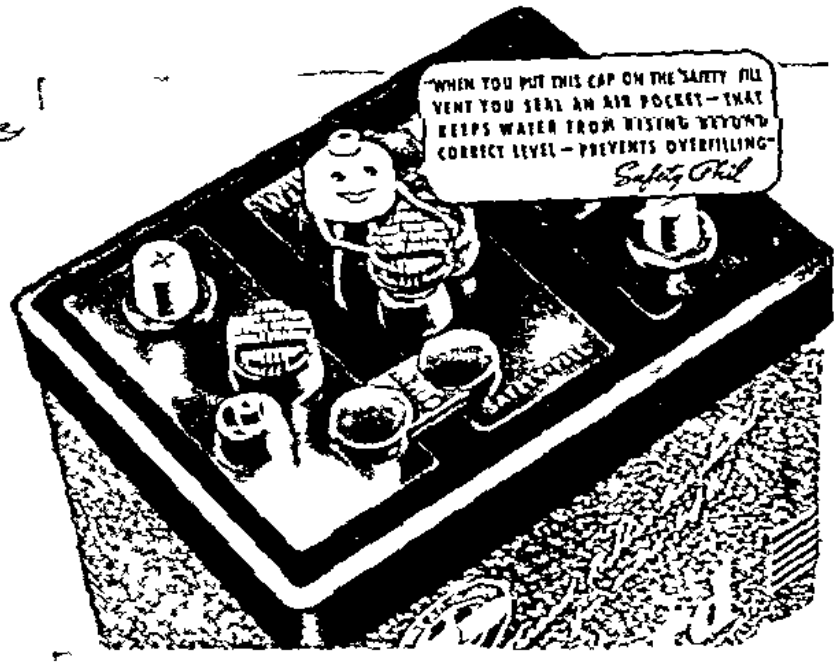
Old Fountain Pen Contains Handy Razor-Blade Knife

FROM an old fountain pen and a razor blade, I improvised a knife that could be carried safely in a pocket and used for cutting clippings. Discard the pen point. Split a 1" length of lead pencil lengthwise and remove the lead. Place a narrow razor blade between the two halves and bind with sufficient cellulose tape to insure a tight fit in the hole from which the pen point was removed. About 1" of blade projects.—M. K.



"Have you heard about the New SAFETY-FILL Willards?"





LONGER LIFE

10-15% more miles and months



These *new* Willards are the finest batteries we have ever built! They give you 10 to 15% longer average life ..even longer than former Willards . . . at *no* extra cost.

MORE RESERVE POWER

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All of these new Willards are built with either *thicker* plates, *bigger* plates or more plates Result —you get longer life plus plenty of *reserve* power for lights radio heater, other accessories—and winter starting

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You know what you're getting



Every Willard has its *guaranteed* ampere hour capacity *molded* in the case You can see *exactly* what you're getting And you pay *only* for what you get. Look for this guarantee of *full measure* of battery value

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SAFETY-FILL BATTERIES

STOP DANGEROUS CORROSION

MORE BATTERY FOR YOUR MONEY!

SOME SMOKERS THINK IT'S

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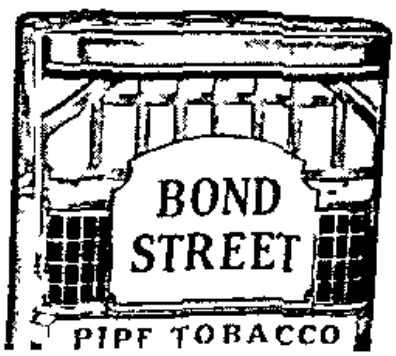
Others *know* there's no tobacco on earth that equals this truly AROMATIC pipe mixture

Some people don t like anything *new*
Here s such a new *different* smoking experience that some men don t like it. But thousands won t touch any tobacco but Bond Street.

Bond Street s like expensive custom blends in flavor fragrance bite free cool ness Contains *rare aromatic tobacco never before used in a popular price mixture*

Even wom en approve its aroma
In fairness to yourself get a 15¢ tin —today!

15¢

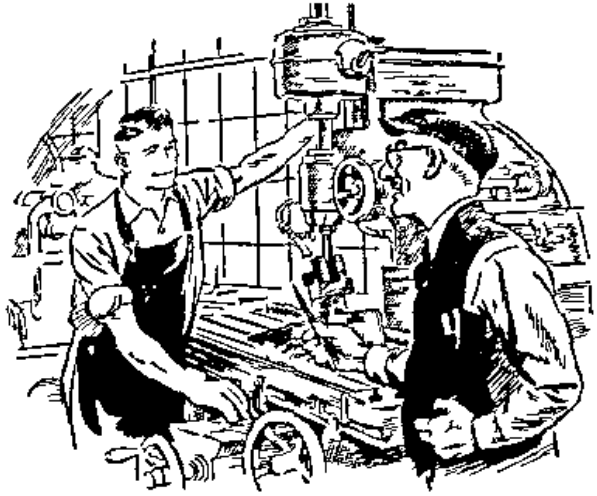


Today—try a tin of

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Pipe Tobacco

A Product of PHILIP MORRIS



Old Bill *says*

A STEEL plate with a substantial layout of tapped holes is a convenience when bolted to the table of a drill press The holes save time in clamping work

• •

It takes a good torch mechanic to cut carbon or high speed steel without scorching but it takes nothing short of an expert to hold a perpendicular cut in stock over 4" thick

•

Rather than take the time to bore a hole accurately in stock held in a three jaw chuck so as to remove 0 002" from a 2" hole in a hardened sleeve having only a 0 072" wall I soldered the part lightly to a V cut angle plate and trued the assembly concentrically on the lathe faceplate

• • •

Bores in A I die castings are usually to size but if they are slightly undersize a hardened and relatively ground burnish ng bar pressed through will produce the required size and give a high finish to the bore

• • •

If you can t afford regular contour sawing equipment metal band saws are so reasonably priced that you can save the slug without tedious drilling and chipping to derive an internal out line Drill holes to clear all corners cut the saw pass one end through a hole weld the saw and go to work

• •

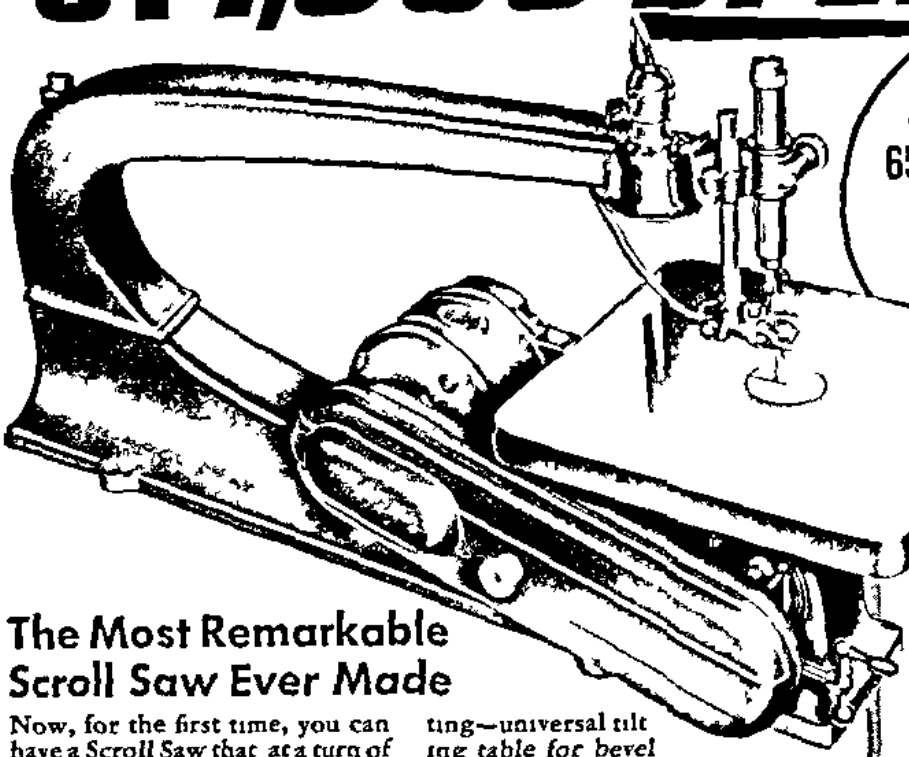
Judging from my own observation I believe that a man with average intelligence can learn more in a week if he stands by a highly experienced machine hand and asks questions than he will in four at one of the training sessions now popping up everywhere

When it is necessary to spot grind the face of a part with a saucer shaped wheel the finish will be absolutely square only if the network of the minute lines is crisscrossed

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Any Speed From 650 to 1700 R. P. M. at a turn of your fingers

The Most Remarkable Scroll Saw Ever Made

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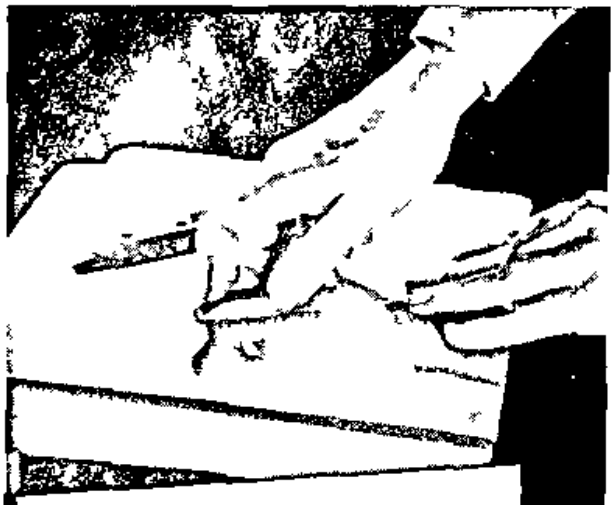
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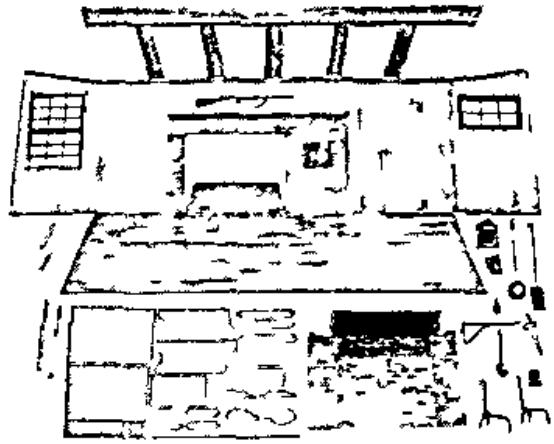
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Colonial-Kitchen Model Added to Our CONSTRUCTION KITS

FUN for the whole family is contained in the construction kit pictured above With it can be built a miniature Colonial kitchen approximately 21" long, 7" high, and 5" deep (see p 206) Accurate in every detail, the model is an attractive example of truly American architectural design Father, mother, son and daughter can share the pleasure of putting it together and furnishing it, although the work can easily be done by one person if desired

The kit costs only $2 00 and consists of all the following walls, floor, ceiling, and fireplace printed in four colors on heavy cardboard, which must be folded into shape, turned legs for table, chair, and candle rack, other wood parts stamped on thin plywood ready to be jig-sawed apart, dowels for chair rungs and stool legs die cast metal andirons, tongs, cooking crane bottle, mug candle bracket, two pans, shovel, and mirror light kettle, two windows; jar of wax, and packages of pins and glue

Construction kits for building a wide variety of ship models three whittling kits, and a marionette kit are also available The complete list follows

MODEL-OF THE MONTH KITS

M	Aircraft carrier SARATOGA 18" long	$1 00
N	Convoy of four U S destroyers for aircraft carrier each 6¼" long	75
R	U S cruiser TUSCALOOSA 11¾" long	1 00
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Z	H M S BOUNTY 8½" hull 11½" over all	1 50
2M	Ocean freighter 14" long	1 50
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5M	Liner PRESIDENT LINCOLN 14¼" long	1 50
6M	Fishing Schooner WE RE HERE of "Captains Courageous 9½" over all	75

(Continued on page 226)

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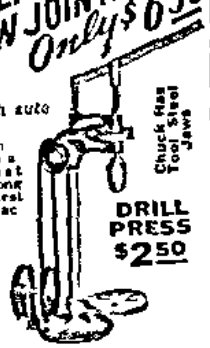


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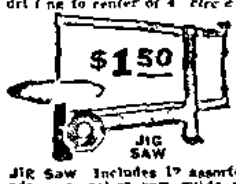
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$1.50 PRIZE CONTEST

Jig Saw Includes 17 assorted blades blade adapters roller saw guide and manual 1 long 8 high 6 y table Cuts wood up to 2" thick

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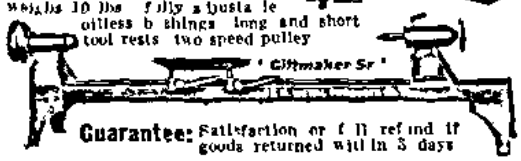


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(Continued from page 224)

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H. Cruiser U.S.S. INDIANAPOLIS 12" long 1.00
J Clipper SEA WITCH, 9½" hull, 13" over all 1.00

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D Spanish galleon, 24" hull, 29" over all 6.98
E. Battleship U.S.S. TEXAS 2' long 7.49*
C Elizabethan galleon REVENGE, 2' hull, 2'6" over all 7.25*
L. Farragut's flagship HARTFORD steam and-sail sloop-of-war 23½" hull, 41" over all 8.49
Q. Privateer SWALLOW a Baltimore clipper 12½" hull, 20" over all ..... 4.98†
V Clipper SOVEREIGN OF THE SEAS, 20½" hull, 26" over all 4.98
Y Trading schooner Maine type 17½" hull, 22½" over all ..... 4.98†
28 U.S. Navy destroyer PRESTON 31½" long 5.95*
26 CONSTITUTION ("Old Ironsides") 21" hull, 31" over all 6.98*
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58 Coast Guard Patrol of 165-ft. type 20¾" long 4.98*
68 Brig MALEK ADHEL, 20" hull, 23" over all frame and plank construction ..... 9.75†
88 Fishing schooner BLUENOSE 17½" hull, 22" over all ..... 4.95†
98 New Bedford whaleboat, with complete equipment, 14" long ..... 2.75†
108. Confederate raider ALABAMA steam sloop bark rigged 21½" hull 25" over all 8.29*
118 Revenue Marine Cutter JOE LANE, a top-sail schooner 12½" hull, 21" over all (Kit contains precision-shaped hull and finished blocks deadeyes bearing pins etc.) ..... 7.00†

MISCELLANEOUS

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8. Whittling kit for six different figurines each is 2" by 2" sawed to shape 1.00
10 Coppercraft whittling kit for making one of several Hobo Hank novelties Includes master model 5¾" high 1.00
12. Marionette kit for making a model of Dopey the Dwarf 9" high. Ready to assemble ..... 2.25†
13. Miniature Early Colonial kitchen 21" long 7" high, and 5" deep with materials for furniture and finished fittings 2.00

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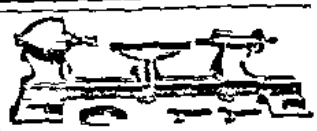
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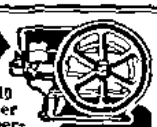
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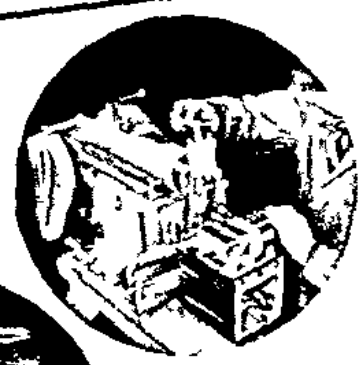


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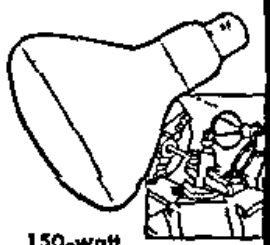


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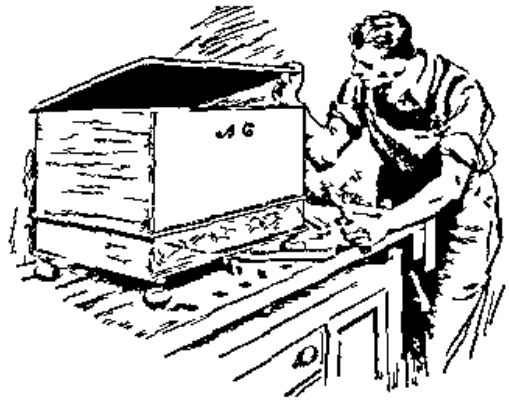
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for workshop and home

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Early Colonial p ne chest plan 308A 25c

Tested Shop Plans for Making Gifts

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Brig MALEK ADHEL 20" hull frame and plank or solid hu l construction 304 305 306 R $1 25
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Clipper Ship SOVEREIGN OF THE SEAS 20½" hull 51 52 53 R 1 00
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CONSTITUTION (O d Ironsides) 21" hu l 57 58 59 R 1 00
Cruiser U S S INDIANAPOLIS 12" long 216 25
New Bedford Whaleboat with complete equip ment 14" long 326 R 50
Pr vateer SWALLOW a Baltimore Clipper 13" hull 228 229 230 R 1 00
Racing Yacht 20 Marconi rigged sail ng model 48 R 50
Spanish Treasure Galleon 24" long 46 47 50
Trading Schooner 17 ½" hull 252 253 50
U S Battleship TEXAS 3 hul 197 198 199 200 1 00

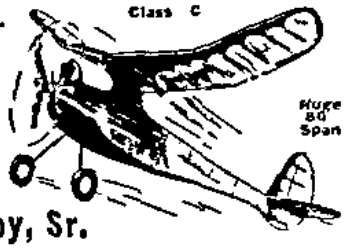


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Cabin Cruiser 17 long weighs 750 lb for use with outboard or inboard drive 356 357 358 359 R 1 50
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High Speed Boat for Small Outboard Motors 7 11" long 257 R. 50
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Sectional Rowboat 9 8 long can be used with small outboard 340 341 R 75
Sport Runabout 9 8" long for small outboard motor weighs 100 lb 309 310 R 75
Ut lity Rowboat 13 long can also be sailed or driven by outboard motor 224 R .. 50

(Continued on page 230)

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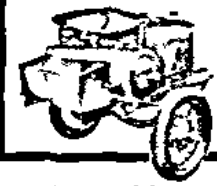
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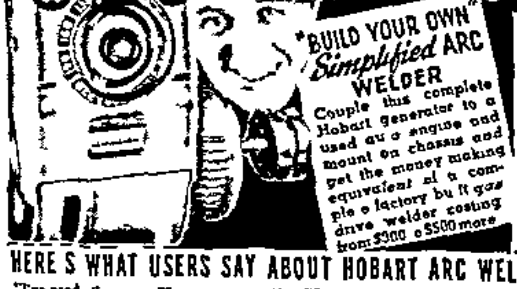
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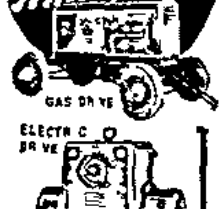


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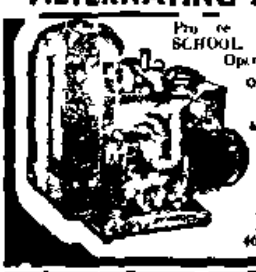
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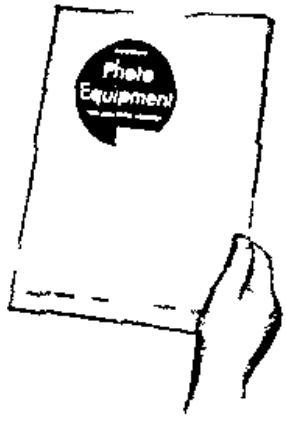
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Other booklets and leaflets ava lable are H nts on Cutt ng and Drill ng Glass 15 cents How to Bu ld and Operate an Inex pensive Arc Welder and Spot Welder 50 cents How to Make Your Own Mario nettes 50 cents and Workbenches and Tool Cabinets 10 cents Be sure to inclose remit tance because C O D orders cannot be filled

Tested Workshop Plans

(Cont nued from pa je 228)



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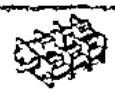
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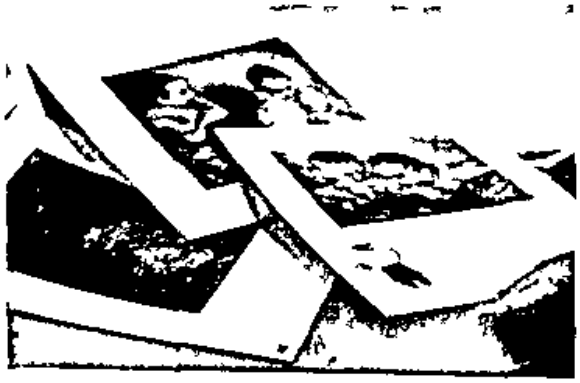


Mounting Prints to Enter in a Photo Exhibition

ANY print you expect to enter in a photographic exhibition should be mounted to conform with certain well established requirements. Even if you have no intention of sending prints to camera shows there are advantages in following exhibition specifications in mounting your better enlargements to form a uniform collection.

The mount must be of light colored or white stock. The choice of mounting board which comes in several different surfaces and tints depends on the type of wall it is to be hung on.

Definite rules are followed in exhibiting prints this way. Although a few salons will accept various other sizes, 16" by 20" is fast becoming the standard mount. Some salons due no doubt to the available hanging space and necessity for uniformity, require that all prints be mounted to permit mounts to be hung *(Continued on page 233)*



vertically There are no borders on the enlargement which is fastened to the board with rubber cement or dry mounting tissue

Good proportions can be obtained by mounting the photograph 2⅜" from the top of the mounting board if the picture is 11" by 14" and 3¾" if 8" by 10 The top border is the same whether the picture is mounted vertically or horizontally Some photographers add title and signature in pencil making the letters about 3/16 high.

No hand colored prints will be hung by any of the larger photographic exhibitions The entry fee which should be mailed under separate cover is required to pay for handling and returning prints

For home display the mounting board may be hung on a small picture hook with the aid of a loop of string glued to the back Neither string nor hook should show



Water Colors Tint Photos

AMATEUR photographers who wish to experiment with tinting some of their pictures can do so at trifling expense by using ordinary water colors Dissolve a little of the desired color in a tray with enough water to cover the print Leave the print in the solution a few minutes until the required shade is obtained then wash them with water The color will remain

Although this is an unorthodox way to tint photos it gives interesting results with certain types of prints For sunny scenes try yellow For pictures taken in the late afternoon orange is appropriate Snow scenes look realistic with a tinge of blue Light green is fine for country scenes. A light shade of red is good for pictures taken at sundown

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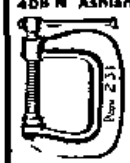
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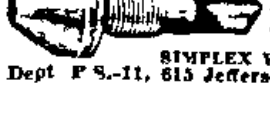


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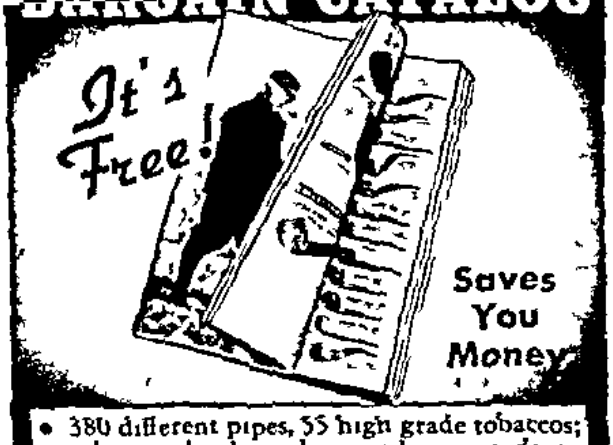
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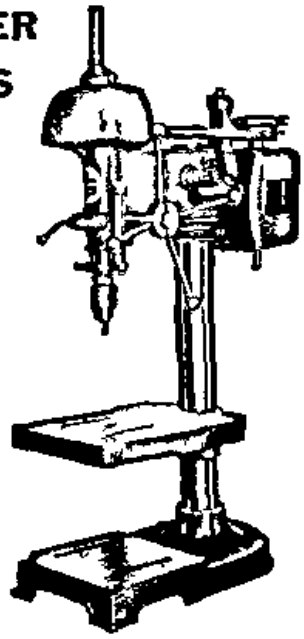
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(Continued from page 76)

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His father died and Farnsworth had to put aside his dreams for a while and go to work. He started a small radio shop—and ironically it failed. He got a job in the railroad yards.

At this point his luck changed however. He met George Everson and Leslie Gorrell two California business men. They listened to him for a while and agreed to put up $8 000 and see what he could do. Farnsworth was sure his star was set now. he married a childhood sweetheart Elma Gardner and the couple moved to Hollywood.

Farnsworth turned the living room of his home into a laboratory. At one time the neighbors got suspicious of the strange young man and the packages he was carrying into his home and the sound of motors operating inside. This was during prohibition and they were sure he was operating a still. They notified the police and the place was raided. The inventor eyes blinking finally convinced the police no liquor was being manufactured on the premises.

Money frequently ran low and between problems Farnsworth had to beg his backers for more. In 1927 he had something to show for his work—his first patent the one on the whole system of electronic television.

At one of the early demonstrations Farnsworth was asked by a banker whether he saw any dollars in that pickup tube yet. Farnsworth answered by televising a dollar sign painted on a sheet of glass. The banker laughed and coughed up more money.

In 1928 Farnsworth gave a demonstration for the press in San Francisco and drew international attention to himself. Three years later he entered into an agreement with a large radio set manufacturer under which his research staff and much of his equipment were moved to Philadelphia.

At the end of that period he established his own laboratory there and carried on research until 1939. Then the plants were moved to Fort Wayne Ind.

Farnsworth is the father of two boys Philo Jr. ten and Russell Seymour four. They live near Fort Wayne. Music is the chief interest in their home and Farnsworth has started to study counterpoint and theory.

He is a heavy cigarette smoker and a big time eater. He is a good shot and a fanatic at auto driving. He races his car up and down the countryside when stumped at the plant. *© New York World Telegram*

The Facts About FM

(Continued from page 72)

that annoyance? Yes As long as the station you want to hear comes in twice as strong as any other station on the same or near by wave lengths you hear only the station of your choice the others will be blocked out completely With AM one station must be from twenty to fifty times stronger than another before it gains the upper hand

◆ *But suppose an FM receiver was located halfway between two FM transmitters broadcasting on exactly the same frequency? Which would you hear?* Another General Electric test will answer this query FM signals were broadcast on exactly the same frequency by two transmitters one in Albany N Y and the other in Schenectady N Y about fifteen miles away An FM radio was installed in an automobile and the car driven between the two cities In Albany and for about half the distance to Schenectady only the Albany transmitter could be heard Halfway between the two cities first one and then the other station would come in depending on the contour of the ground over which the automobile was passing But either station could be heard in this halfway zone when a directional antenna was employed As the car proceeded toward Schenectady, only the transmitter there could be heard At no time during the entire run did the transmitters interfere

◆ *Without getting technical just what is the difference between FM and AM?* To answer that without wallowing hip deep in technicalities is practically impossible even if you are one of the few radio owners who understand exactly how their sets function But with amplitude modulation the signal is broadcast on a constant unvarying wave length with the sound modulations being accomplished by varying the power or amplitude With FM the reverse is true The power is constant, and the modulation is accomplished by varying the wave length or frequency within a narrow limit.

◆ *Will FM be used only for regular broadcasting?* No it has revolutionary possibilities in the fields of police aviation and military radio as well The Chicago Police Department after a series of tests with two patrol cars cruising side by side one equipped with an AM set and the other with an FM plans to install FM equipment in 200 police cars The U S Army and Navy also have been experimenting with FM

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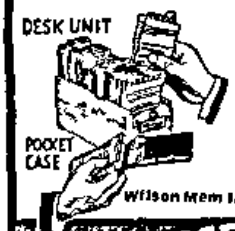
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Bombers Beware!

(Continued from page 69)

fighting forces We still are short on quantity, but our gunners, guns, fire-control instruments and searchlights are as good as the best any nation can offer

For defense against high-altitude major-bombardment aviation the 105 millimeter antiaircraft gun is our most effective weapon It can deliver rapid and accurate fire to an altitude of over five miles at a horizontal range of four miles But the "105" is a fixed gun so its use is restricted to certain strategically important locations

At present the three inch antiaircraft gun, which is effective against planes flying well over three miles up, is the most powerful mobile sky weapon we have in anything like quantity. A new ninety-millimeter gun now is considered standard equipment, although its issue is just beginning It is effective at higher altitudes than the three inch gun, and the burst of its heavier shell creates a larger danger space

The snappy little thirty seven-millimeter antiaircraft guns, which fire 120 1½-pound explosive shells a minute, have proved their worth for use against planes flying below 10 000 feet, and the 50 caliber machine gun remains a decidedly effective weapon against daring hedge-hoppers

We now have seven antiaircraft artillery regiments in the Regular Army, and eleven in the National Guard At least twenty more regiments will be organized as soon as equipment for them becomes available

Balloon barrages have become familiar ornaments of European wartime landscapes Officers of the Air Defense Command are convinced that, coordinated with pursuit aviation and antiaircraft artillery, they would be a valuable addition to our air-defense system

No matter how efficient air defense methods may be, some planes are sure to break or sneak through, and the bombs they drop are certain to do damage To keep that damage to the minimum, to care for the injured, and to prevent unavoidable confusion from deepening into panic police and civilian volunteers must be trained to perform special air-raid duties This highly important part of air defense has not been neglected Detailed instructions for air-raid workers have been worked out, and soon will be printed and sent to municipal governments for issue if the need arises

Everyone hopes that we'll never see or hear enemy planes over America—but the Air Defense Command is determined that if they ever come over we'll be ready for them!

Speed Is His Business

(Continued from page 152)

ments of drama have been provided by Wilbur Shaw There was the time when his car hit an oil slick and shot sidewise al most the full length of the straightaway while he wrestled with the wheel to prevent a spin There was the heartbreaking climax of another speed battle when he was streak ing along well in the lead and a throttle connection snapped Then there was the fireworks of 1931 Out of control at high speed Shaw s car hurled itself over the concrete wall landed upright and slithered to a stop Unscratched he climbed out and finished the race in a teammate s machine

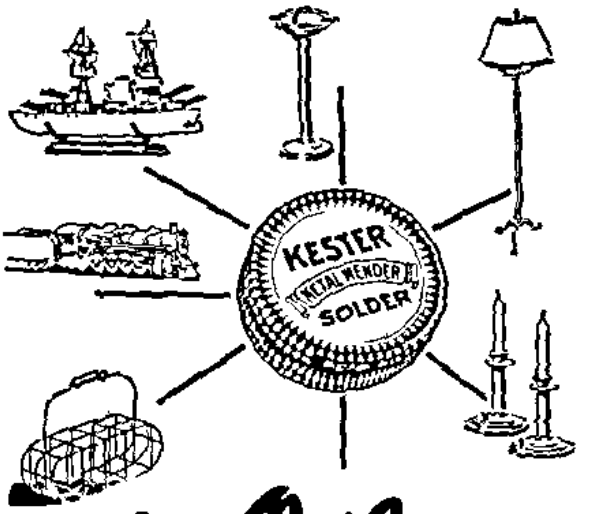
Each year people from all over the United States send Shaw good luck charms to carry during the race This spring one woman forwarded a buckeye and reported she had won seven international contests since she had been carrying the luck bring ing nut From Long Island a druggist sent a tiny wooden man labeled Ptomaine Tommy He wrote that the figure was so lucky it was good for anything but money at the bank Just before he went to the starting line last Memorial Day Shaw looked under the seat cushion of his 350 horsepower $20 000 Maserati and found what looked like the nest of a pack rat There were lucky pennies miniature horse shoes rabbits feet old washers and buck eyes A superstitious mechanic in the pit was taking no chances He had collected all the lucky charms he could get and had hidden them in the car!

Most drivers are as superstitious as crap shooters Shaw is pretty much of an ex ception He is the only driver for instance who will let a woman have her picture taken sitting at the wheel of his machine—a thing that sends chills down the back of the average driver The lucky charm Shaw re lies on most is careful preparation With him driving is a business and a specialized science He practices every track maneu ver until it becomes instinctive He helps tune up his car to as near mechanical per fection as possible He was the first driver in America to wear the common sense crash helmet which has since become conventional

In racing he explained you don t have to have good luck But you mustn t have bad luck!

His skill and preparations take care of his good luck and a pair of half hearted super stitions ward off the bad One of these is his lucky racing shoes a nondescript pair of leather sneakers he has worn in every

(Continued on page 240)



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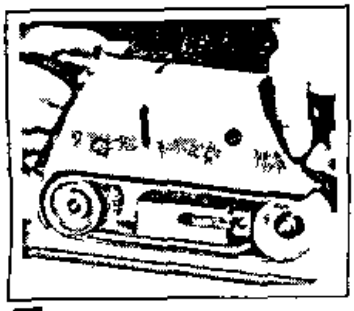
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Speed Is His Business

(Continued from page 239)

race for fifteen years The other is his taboo against peanuts in the pit Years ago a Swedish mechanic named Olsen warned him that peanuts in the pit meant bad luck on the track Shaw scoffed at the idea until at a race in California he saw a spectator munching peanuts lean over the edge of the pit to ask a question Five minutes later he cracked up in the worst wreck of his career There might be no connection between peanuts and crashes he decided but he wouldn t take chances Henceforth peanut munchers became taboo around the Shaw pit

After every victory Shaw receives a del uge of mail His sudden wealth is a magnet that draws letters from a thousand and one stock salesmen real estate operators charity leaders and impoverished inventors People with dude ranches for sale people with mortgages that are going to be fore closed people who are sick people who have bright ideas and get rich quick schemes all sit down with pen in hand to write to Wilbur Shaw

The queerest of all these communications came in only a few weeks ago It was written by an elderly inventor He desired backing for a revolutionary idea that would simplify farming It was a machine so long that the front end would plant the crop the middle part would cultivate it and the rear end would harvest it!

Today Shaw s private stable of high-speed vehicles includes an airplane he flies himself an imported motor cycle and three automobiles—one of them a specially built roadster said to be the fastest private car in the world At the end of his racing rainbow Shaw has found not only a pot of gold but all the speed machines he dreamed of having as a boy

Novel Horizontal Billboard Read by Plane Passengers

GIANT lying down billboards intended to be read by airplane passengers may be an important new development in outdoor advertising What is said to be the first display of this kind has been erected near the Chicago Ill airport, on the roof of a plant manufacturing surgical dressings Built of neon tubing the horizontal billboard displays the firm s trade mark in a figure twenty feet across The sign is seen by hundreds of arriving and departing plane passengers every day

Gus and Joe Go to the Show

(Continued from page 140)

have a blow-out, and they're said to make a flat tire ride as though it still had ten pounds of air," Gus declared

'Say! We can't afford to miss these Hudsons," he added "Look at the Six and the Six Traveler—116-inch wheelbases, engines which have been upped to ninety-two horsepower by increasing their compression, Symphonic Styling which assures the ladies a harmony of exterior and interior colors, and don't forget that goes for the low-price group! Then there are the Super-Sixes and Commodores—larger and more expensive Lots of improvements on all of them—a cowl ventilator which you can leave open during the heaviest rain storm, larger brake drums, and a new clutch pedal mechanism which requires only three quarters as much effort to operate as the old one did"

Gus pulled out his watch "Holy Moses!" he exclaimed 'Only a half hour to closing time, and you haven't even seen the new Buicks!"

Wide, low bodies, dashingly streamline, were the Buick features which first caught Henry's eye.

"Yes, they look good" Gus agreed with him 'But there are a lot of just as important improvements which don't show on the outside Increased power, for one One of the reasons for that increase is an improved bearing—it took the Buick engineers five years to develop exactly what they wanted, but they've got it now. Then there's compound dual carburetion That's something brand new It costs a little extra on the Series 40 engines, but is standard on the larger ones By using two dual—double-barrel—carburetors instead of one, better mixture ratios of air to gasoline are fed to the engine, power is increased, acceleration and hill-climbing improved, and fuel consumption cut down Another new feature is the method of forcing fresh air to the carburetors with an air scoop set up in the radiator grille. The air is piped to the air cleaner above the carburetors and it's actually under pressure from the car's forward motion!

"There's another thing To squeeze the most power out of the gasoline, they've redesigned the piston heads so the mixture in each cylinder is compressed into a tiny ball right around the spark plug When the spark ignites it, they get the maximum pick-up and power from the explosion, with-

(Continued on page 242)



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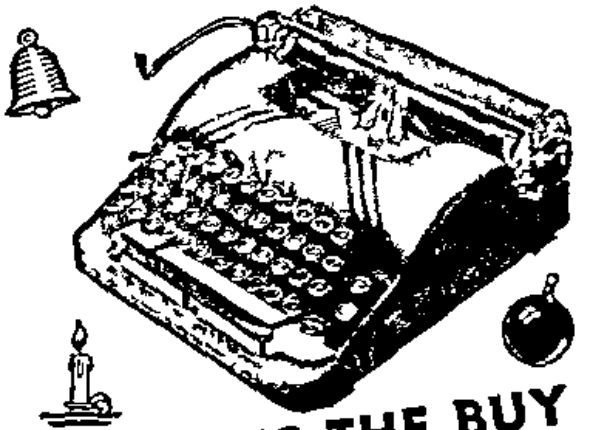
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Gus and Joe Go to the Show

(Continued from page 241)

out any ping or detonation—knock to you.

Say, here's something. Gus broke off suddenly to the relief of Miller whose brain was beginning to knock a little itself under the high compression of Gus's explanations. The Buick Bug. Famous old racing car! Brother, do I remember back in 1910 when Louis Chevrolet was busting speed records right and left with it. Look at that radiator—behind the motor. Just a bunch of curved pipes with fins on them. It didn't even have a fan then. Notice that Buick had overhead valves then—and has stuck to them ever since.

Like Chevrolet, interrupted Miller. 'They still have overhead type valves too, haven't they?'

Right, answered Gus.

Passing the Chevrolet display again, Gus remarked, They've redesigned the combustion chamber this year so the new Chevrolets will turn up ninety horsepower instead of eighty five. And the wheelbase is increased to 116 inches to give you a steadier smoother ride.

Yoo hoo! Henry! Mr. Wilson! Mrs. Miller's voice was calling from across the aisle.

They went over to her and Joe, feeling properly ashamed of themselves for having played truant for so long. But Mrs. Miller didn't seem to care, and Joe Clark was looking both self satisfied and faintly embarrassed.

I've decided which car we want, Henry, Mrs. Miller told her husband. Mr. Clark advised me about it, so you needn't worry. The salesman is going to bring it out for you to see next Sunday morning. And what do you think Mr. Clark has done?

Gus looked hard at his partner and Joe got red in the face.

He's either robbed a bank and got away with it, or he's bought a new car, Gus said.

Well, my old bus is worn out—you said so yourself, Joe defended himself rather sheepishly. I'll bet you bought one yourself—it was you who wanted to come to the show.

I didn't buy anything except my ticket to get in, Gus said cheerfully. I like all these new gas buggies too much to settle down to any one of them.

Isn't that just like a man? Mrs. Miller demanded. Then she giggled. Mr. Wilson, I'll just bet that you felt the same way about girls and that's why you never got married.

Testing Your 1941 Car

(Continued from page 135)

out the assembled cars at the proving grounds How much water will spurt up through cracks and slots in the floor? What will happen when the brake bands get wet? Can the ignition system and the carburetor take a ducking without stalling the car? A thirty mile an hour splash through the bathtub a street wide trough of water, settles these questions

Driving in circles of ever narrowing diameter provides a novel test for a car's stability in turning corners It also compares the merits of various nonskid tires At a 108 foot radius the motor strains and tires scream as the test driver holds the accelerator down to the floorboard A passenger has to cling to the door handle to keep from sliding across the seat Yet the speedometer registers only thirty two miles an hour According to General Motors men who devised the test that is about as fast as any car will go in such a small circle because of the power used up in forcing the car to turn

Another odd test shoots an artificial hurricane at the side of the car so that the amount it swerves can be measured At the Ford proving grounds the blast is provided by a four bladed fourteen foot propeller driven by a 750 horsepower engine and mounted so that it can be aimed either broadside or diagonally to create crosswinds

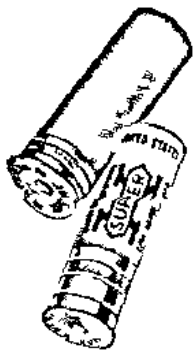
How important car makers consider this intensive testing may be judged from the fact that in the up to-date Chrysler engineering laboratories as many as 2 500 different research projects may be found under way at once Current experiments range from testing the life of seat cushions with a metal form nicknamed the lead fanny to heat treating parts with radio waves

For the latter purpose the engineers have designed an electrical device resembling the artificial fever or diathermy apparatus used in hospitals Placed in a high frequency coil without touching it a gear or other metal part is heated by induction *from the inside out* attaining a high temperature in a split second Valuable experimental data may thus be quickly obtained for nearly all of a car's mechanical parts owe their hardness or softness to heat treating

Perhaps in the future this kind of electric heat treatment may actually become commercial practice It would not be the first time that car research men have pioneered an outstanding advance Always they are working on two jobs at once—planning for the current year's models and for the car that may come some day



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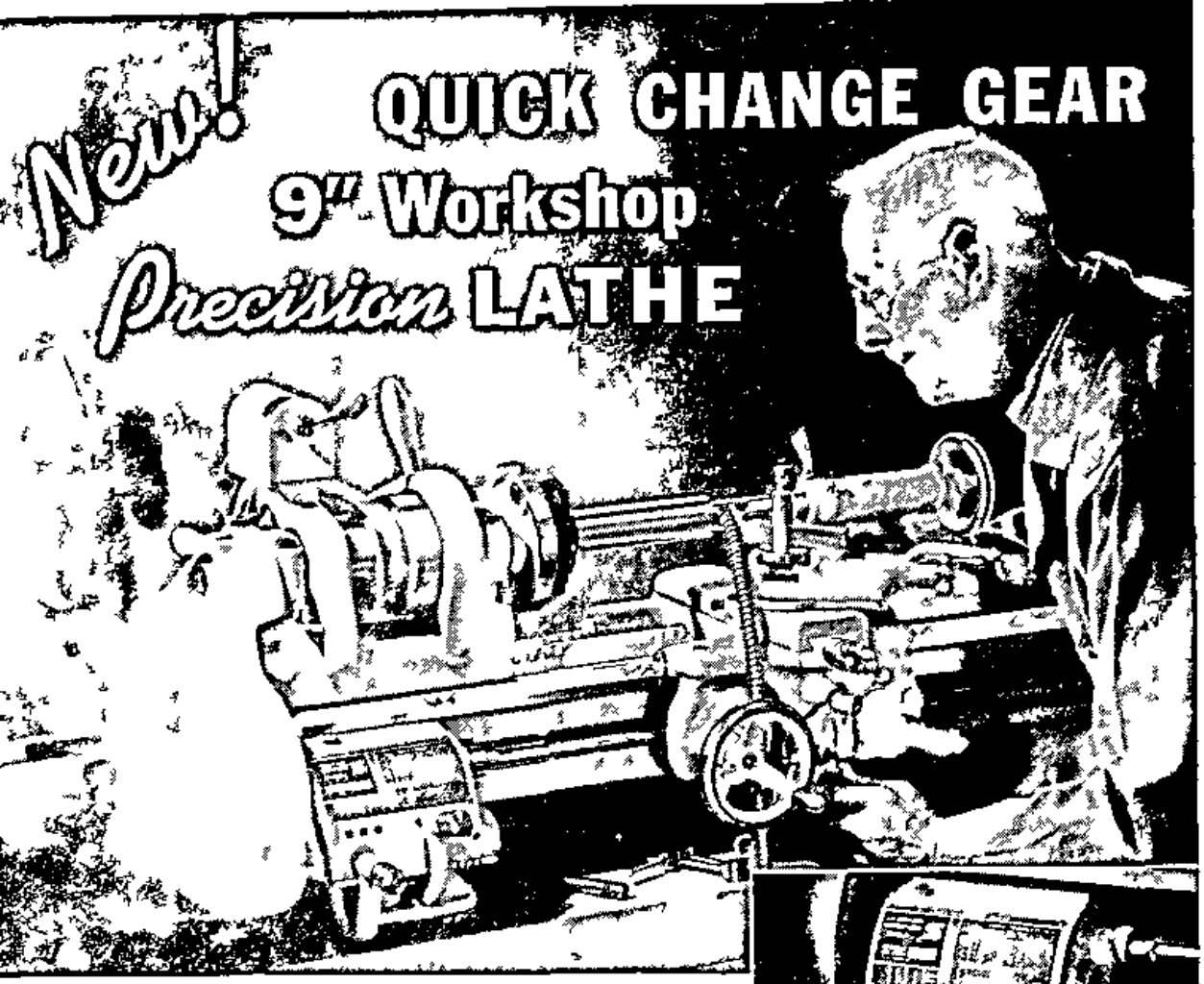
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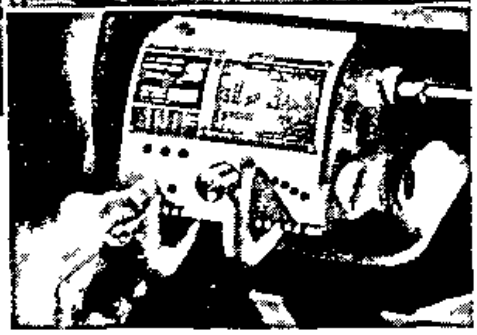
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Just before the ma den fl ghts of America s first Stratol ners —stratosphere ace Tommy Toml nson (*center*) takes time to enjoy a slow burn ng Camel w th p lots Or s F Bryan (*left*) and John E. Harl n (*right*)



He outflew the weather for Extra Speed

IN THIS FLYING TEST TUBE above Tommy Toml nson p oneered the newest wonder of a r travel—the Stratoliner He likes flying likes Camel cigarettes

There s never a t me—no matter how much I smoke—that I don t get a fresh thrill out of a slow burn ng Camel That extra flavor is always welcome

He turned to Camels for Extra Mildness

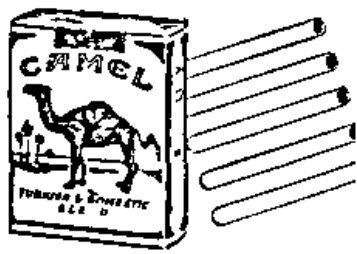
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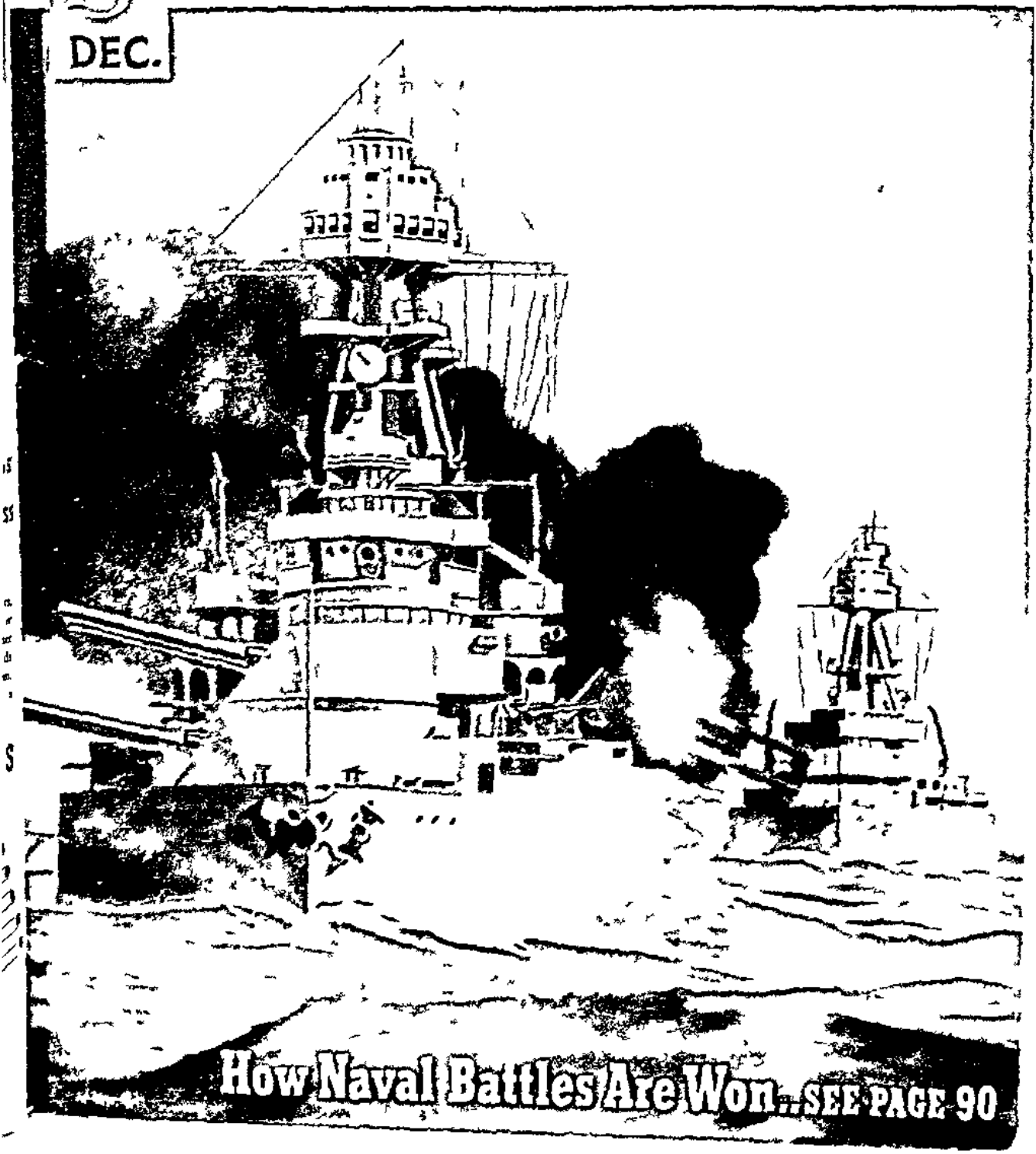
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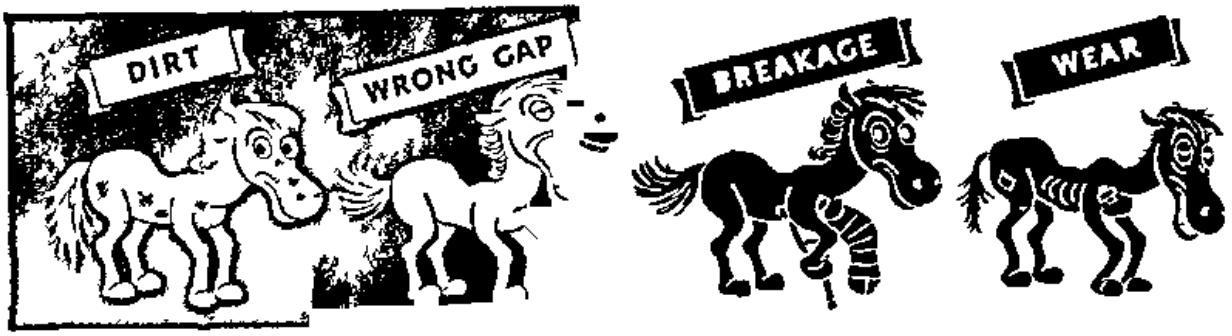
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How Naval Battles Are Won..SEE PAGE 90



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fused, or blistered, it s oxide —a residue of combustion.

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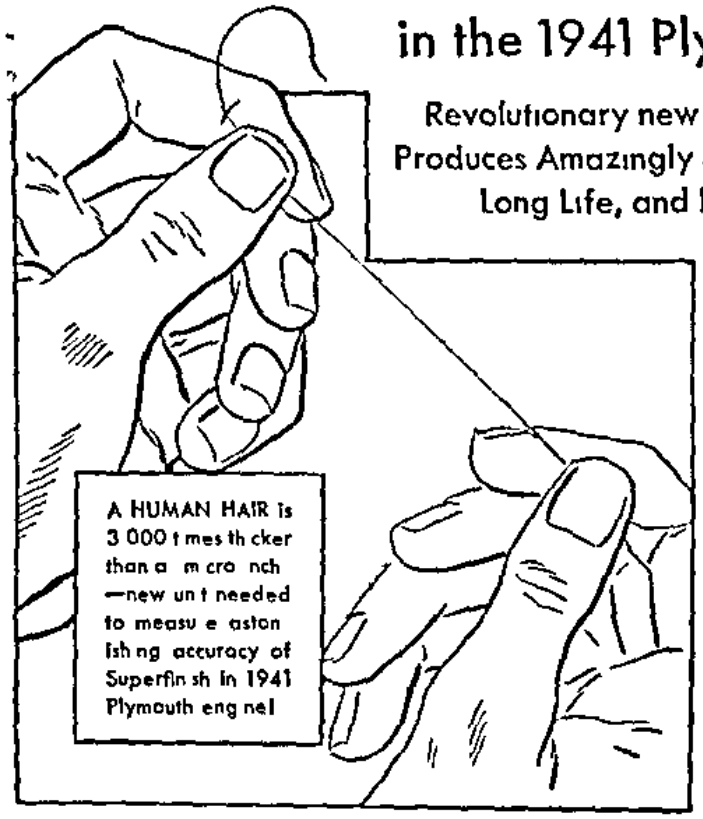


Replace worn plugs with New AC's for Better Performance

HOW SUPERFINISH PUTS FRICTION ON THE SKIDS

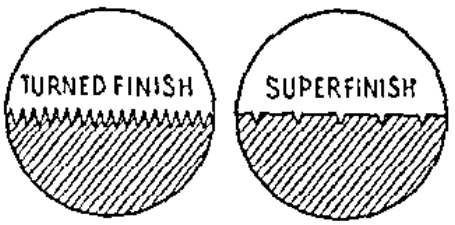
in the 1941 Plymouth

Revolutionary new Method of Finishing Engine Parts Produces Amazingly Smooth Surfaces—Extra Quietness, Long Life, and Economy in the 1941 Plymouth

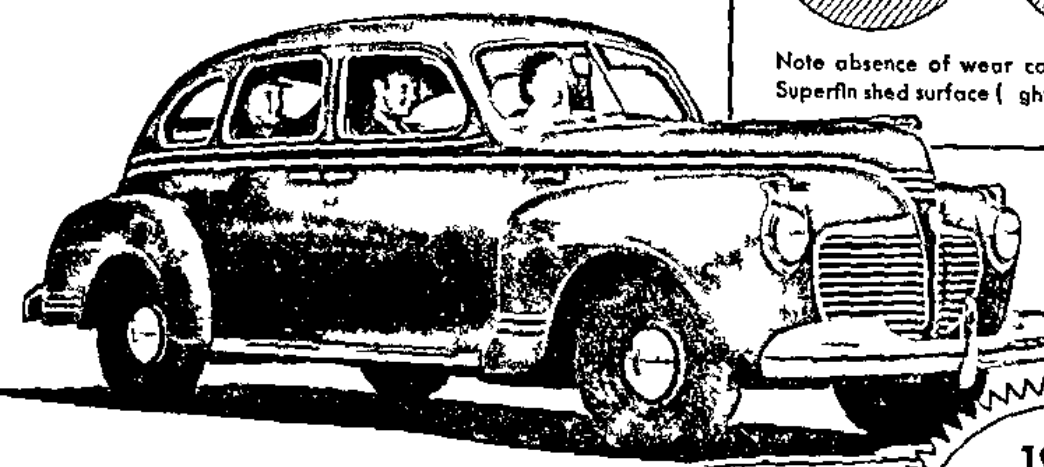


SUPERFINISHED surfaces of the 1941 Plymouth engine are virtually *immune* to friction and operating wear, when properly lubricated! Superfinish *scrubs off* tiny sharp surface irregularities that might otherwise puncture the microscopically thin film of oil which separates and prevents wear between the moving parts of the engine!

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VOLUME 137—NUMBER 6

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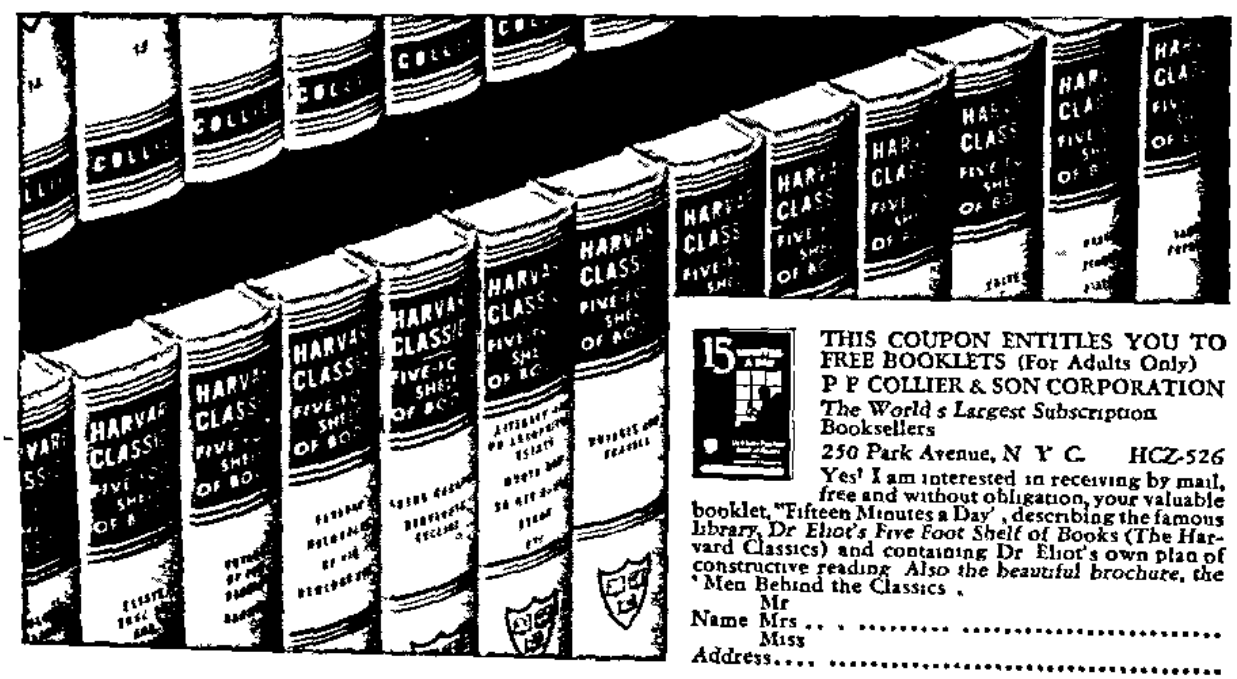
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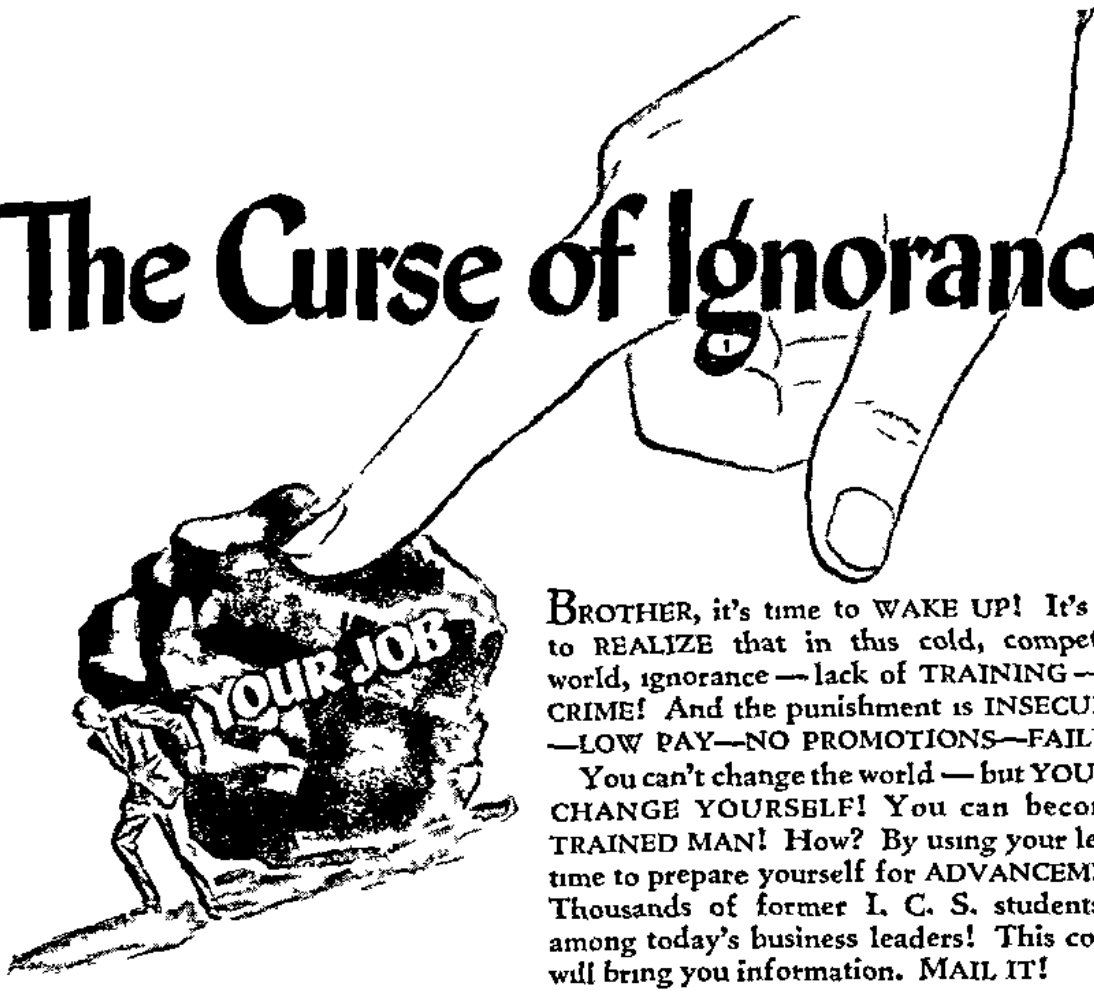
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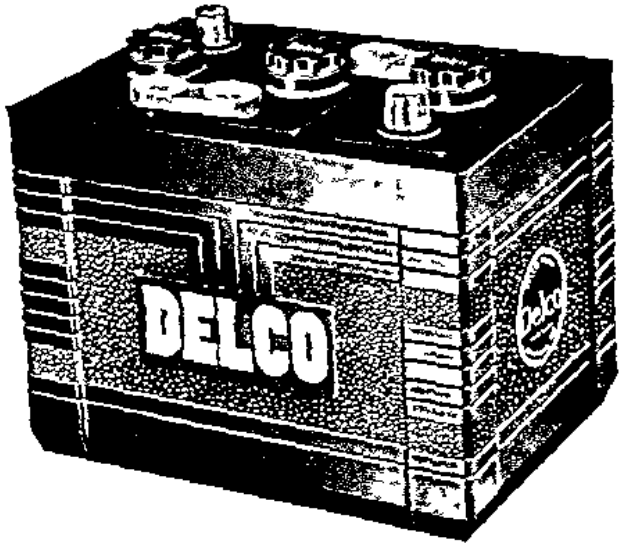
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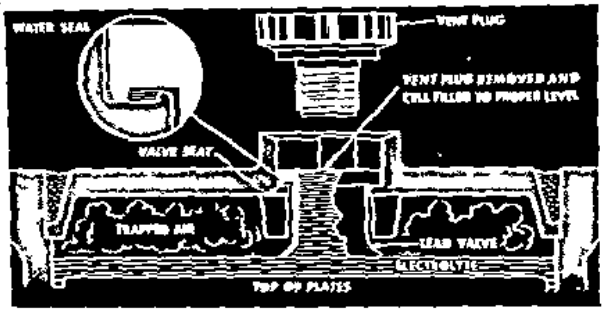
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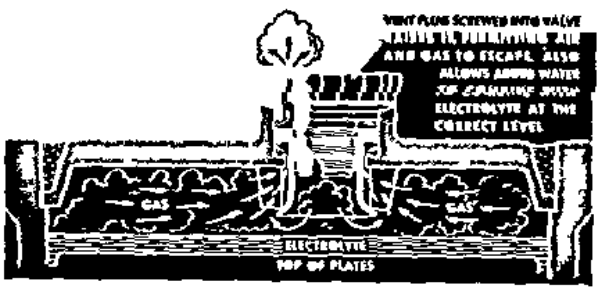


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Leading cars in every price field come equipped with powerful Delco batteries because their manufacturers know the dependability this Delco-Remy product provides. When you need a new battery for your car, regardless of make or model, there is no surer way to get real value than to follow the example of these car manufacturers.

Replace with a Delco battery . . . there's a Delco battery dealer near you.





THE NEW DELCO ELECTRO-LEVEL

Safeguards against overfilling . . . automatically

Delco batteries now feature the Delco Electro-Level, which simplifies the filling problem and prevents overfilling. It goes into action immediately and automatically when the vent plug is removed. A valve sleeve drops down and forms a water-sealed air lock in the cell when the right electrolyte level is reached; there are no extra steps—it is entirely automatic in operation.

Delco-Remy

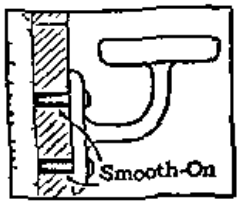
Anderson, Indiana

World's Largest Manufacturer of Automotive Electrical Equipment

HOW to REPAIR Cracks, Leaks, and Loose Parts at least cost



Sealing Crack in Boiler



Tightening Loose Fixture

In every household repair jobs are sure to be required from time to time The boiler heater or a radiator may leak a pipe may split, the auto water jacket or gear case may crack and handles of tools utensils doors umbrellas etc., are always coming loose

A little Smooth On No 1 will permanently cure each of these and many similar troubles

Protect yourself against such emergencies by getting a can of Smooth On and keeping it handy The first application will pay for the can many times over and a can will last a long time to save you from many an expensive repair job

Buy Smooth On No 1 in 1¾-oz 1 lb or 5 lb cans from your hardware store or if necessary from us For your protection insist on Smooth-On used by mechanics and repair men since 1895

FREE



40 Page Repair Handbook which will enable any handy man to be his own repair mechanic on dozens of jobs that would otherwise mean the delay and expense of getting a professional 170 Diagrams show ingenious and practical methods of making cracked broken leaky or worn apparatus as good as new This useful guide is literally a necessity in every home and shop and will be sent you FREE if you fill in and return the coupon

SMOOTH ON MFG CO
Dept 58 574 Communipaw Ave
Jersey City N J
Please send Smooth On Repair Book

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Address _____

12-40 _____



Do it with SMOOTH-ON

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HOW LONG? HOW LONG?

THIS HEART-BREAKING

MONOTONY?

THIS WRETCHED PAY?

"If I Could Only Recover Those Ten Lost Years!"

[The True Experience of a Man Who *Almost* Enrolled for LaSalle Home-Study Training]

In December, 1921, an American employed with a mining firm in Mexico, clipped and signed a LaSalle advertisement coupon *But he did not enroll!*

Ten years of silence followed . . ten years of haphazard jobs, long hours, wretched pay .

Then, in January, *nineteen thirty two*, that silence was broken by a dramatic letter, high-spotted by these words *"Please send the first lessons with the least possible delay, as time is a highly important factor to me in this year of our Lord"*

Through five typewritten pages he recounted the hardships of those intervening years A really able man, he had moved from one position to another, only to find advancement closed to him for lack of specialized training

No need here to recite those hardships—though in justice to him it is only fair to say that on four separate occasions he had *almost* enrolled . . . and that on each occasion he had postponed action because of some unexpected reverse seemingly beyond his power to avoid

"For five months now," so he wrote, "I have been 'on vacation' Not a chance to take a course now—according to my carefully laid out and conscientiously followed program . . .

"But—supposing I had *chucked* that program at any time in the last 10 years? Supposing I had enrolled, in the face of seeming disaster, even though I had had to borrow the money to do it? Supposing even that I had enrolled only five months ago, at the beginning of my enforced vacation? In all likelihood I could have mastered the training by now Or I might in the meanwhile have found a congenial and profitable position, thanks to my increased knowledge As it is, for all I know, there may be another five months without any position with all sorts of dim prospects . and meanwhile I am getting older . .

"That settles it! To blazes with further procrastination! To thunderation with my financial program! I've borrowed the money, and I'll borrow some more . but I'll do something with my time! This year is going to see a big change in my affairs—and right here is where we start!"

Send for Free Booklet

These are searching times—and wise is the man who takes full measure of his competition . gets the special training that he needs . . and thus commands the unfolding opportunities of our new-day business world

If you need to be *convinced* of those opportunities, forget that you ever read this message For those opportunities are not for you . .

But if you are determined to be out in front when men are picked for leadership one year, two years, ten years from now—do not, on your life, risk a day's delay.

Below is a coupon It will bring you—without cost—books that have led to increased earnings running into many thousands of dollars! Men of action—*hundreds of them*—will use this coupon for their personal advancement Be one of those men who will steadily win their way to the better-salaried positions



Ask for one of these booklets—or a similar one on your own field of business That are FREE!

LASALLE EXTENSION UNIVERSITY

A Correspondence Institution

Dept. 1283 R Chicago, Illinois

I would like to have your special booklet—without any cost or obligation to me—about my opportunities and your success training in the business field I have checked

- ☐ Business Management
- ☐ Higher Accountancy
- ☐ Traffic Management
- ☐ Modern Salesmanship
- ☐ Commercial Law
- ☐ Law *Degree of LL B*
- ☐ Expert Bookkeeping
- ☐ C P A Coaching
- ☐ Industrial Management
- ☐ *Modern Foremanship*
- ☐ Business Correspondence
- ☐ Business English
- ☐ Effective Speaking
- ☐ Stenotypy

Name_____ Age_____

Position_____ Address_____

Our Readers Say



Now He Has a Shop of His Own, He s Going To Catch Up

Belie e it or not I have been a reader of Poplar Science Monthly for about thirty years—not every issue of course but steady when I was located where I could get it I have nearly every issue for the last eight or ten years and now at long last I have a l ttle shop and am going to make many of the things described in those old numbers Many times I ve wanted to write and say what a swell magazine I thought it was especially when I read some of the letters in Our Readers Say from fellows who wanted you to change the entire magazine to suit their one tiny whim Often I wondered why they didn t buy a book devoted to their particular likes You ve made a success of the magazine as it is and has been yet there is always some one trying to tell you how to run it chances are they couldn t run a peanut stand and make a go of it So I says says I keep her the way she is and more power to you —J P T Leavenworth Wash



Before Long, We'll Be Afraid To Go into the Kitchen

In a recent issue one of your readers told of an experience with an exploding pepper shaker Here is another mystery that almost parallels his case We were preparing to go on an outing and had packed several things to take along including a glass jar of ground coffee It rained as it usually does so we were spending our time at home when we heard a no se like glass breaking in the kitchen Investigation showed that the top of the coffee jar had blown off The temperature in the room was about fifty five degrees and the temperature of the ground coffee was normal The lid was not too tight and the jar was not in a draft I wonder whether any of your readers can offer an explanation for this mysterious explosion —L P Huntington Ind



He Knows What Makes the Wheels Go 'Round—Backward

Although I am only fifteen years old I happen to know the answer to the question asked by G B of Riffle W Va about wheels that seem to turn backward in the movies It bothered me at one time The reason the wheels appear to go backward is that the movie camera takes one p cture when the spokes are in a certain position and when it takes the next p cture another spoke is in a position sl ghtly back of where the first spoke was before When this is repeated many times the spokes appear to move backward As the wagon slows down the camera catches the spokes in their proper positions and the wheel appears to move in the right direction —G M Columbus Ohio

Many readers sent in letters answering G B s question We publish G M s because it is so clear and simple and so good an example of straight thinking in a fifteen-year old —Ed

Physician Misses Monthly Mental Going Over

What happened to the Question Bee? Now I have no way of knowing how dumb I really am Better get busy and check up on me next month —(Dr) D W K Seattle Wash



For a real mental test we suggest that the Doc try thinking up some questions these birds can t answer —Ed

That Siamese Twin Bike Is Still Going Strong

M L of Winnipeg Canada says that he and his cousin reached speeds approaching fifty miles an hour on a pair of bicycles hooked together I recently made a twenty seven mile trip on my own bicycle alone in ninety-one minutes A few days later I made the same trip with a friend using our bikes in Siamese twin style and this time it took much longer I was not loafing on the rear seat either One disadvantage of the two-

(Continued on page 12)

I Jumped My Pay from $18 to $50 a Week!

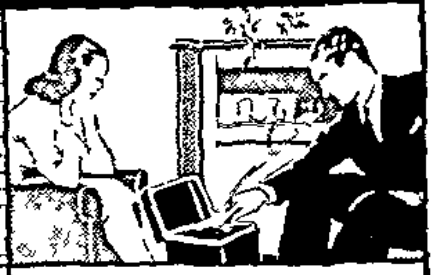


Here's how I did it

by S. J. E.
(NAME AND ADDRESS SENT UPON REQUEST)



I had an $18 a week job in a shoe factory. He'd probably be there today if he hadn't read about the opportunities in Radio and started training at home for *them.*



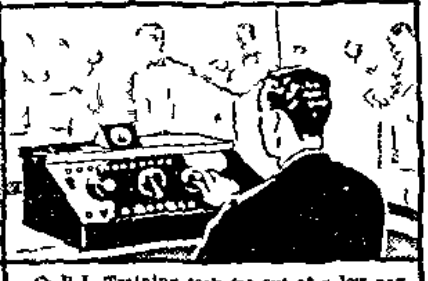
The training National Radio Institute gave me was so practical I was soon ready to make $5 to $10 a week in spare time servicing Radio sets.



When I finished training I accepted a job as Radio serviceman. In three weeks I was made service manager at $40 to $50 a week, more than twice my shoe factory pay.



Eight months later N.R.I. Graduate Service Department sent me to Station KWCR where I became Radio Operator. Now I am Radio Engineer at Station WSFJ and connected with *Television Station* W9YK.



N.R.I. Training took me out of a low pay shoe factory job and put me into Radio at good pay. Radio has enjoyed a colorful past. It will enjoy an even greater future.



J. E. SMITH
President
National Radio Institute
Established 25 years

Find out today how I Train You at Home to BE A RADIO TECHNICIAN

If you can't see a future in your present job, *feel you'll never make much more money, if you're in a seasonal field subject to lay-offs* IT'S TIME NOW to investigate Radio. Trained Radio Technicians make good money and you don't have to give up your present job or leave home to learn Radio. I train you at home nights in your spare time.

Why Many Radio Technicians Make $30, $40, $50 a Week

Radio broadcasting stations employ operators, technicians. Radio manufacturers employ testers, inspectors, servicemen in good pay jobs. Radio jobbers, dealers employ installation *and servicemen. Many Radio Technicians* open their own Radio sales and repair businesses and make $30, $40, $50 a week. Others hold their regular jobs and make $5 to $10 a week fixing Radios in spare time. Automobile, Police, Aviation, Commercial Radio, Loudspeaker Systems, Electronic Devices are other fields offering opportunities for which N.R.I. gives the required knowledge of Radio. Television promises to open good jobs soon.

Many Make $5 to $10 a Week Extra In Spare Time While Learning

The day you enroll I start sending you Extra Money Job Sheets—start showing you how to do Radio repair jobs. Throughout your Course I send plans and directions which have helped many make $5 to $10 a week extra in spare time while learning. I send special Radio equipment to conduct experiments and build circuits. This 50-50 training method makes learning at home interesting, fascinating, practical. YOU ALSO GET A MODERN PROFESSIONAL ALL-WAVE ALL-PURPOSE SET SERVICING INSTRUMENT *to help* you make money fixing Radios while learning, and equip *you for full time* work after you graduate.

Find Out What Radio, Television Offer You—Mail Coupon

Act Today. Mail the coupon *for my* 64 page book. Read how Radio's spare time and full time opportunities and those coming in Television; tells about my Course in Radio and Television; shows more than 100 letters from men I have *trained* telling what they are doing and earning. Read my money back *agreement.* MAIL COUPON in an envelope or paste on a penny postcard—NOW!

J. E. SMITH, President
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Mail me FREE without obligation your 64 page book Rich Rewards in Radio. (No salesman will call. Write plainly.)

Age _____

Name _____

Address _____

City _____ State _____

Our Readers Say (CONTINUED)

b cycle plan is that the rear man must use his brake first and he cannot see ahead very well—D D Toledo Ohio

Introducing Si, the Big Guy Who Draws the Little Guys"

With the changes you have made in the size and make up of P S M I think it beats any other scientific magazine on the market regardless of price I am offering no suggestions for improvement but there is one thing I would like to mention I get a big kick out of the little guys that decorate the pages of Our Readers Say and I think the art st who draws them should come out of hiding and take a bow —A C Jr La Monte Mo



When he is not showing yo i the insides of some compl cated gadget l ke the Palomar telescope (page 107) B G Seielstad gets a kick out of drawing the little guys Such is his modesty that the accompanying self-portrait doesn t do him just ce Ed.

That Gun Cabinet Hit the Mark with This Michigan Trapper

That Gun Cabinet of Knotty Pine de scribed in your September issue works fine in my trapp ng cabin Put more of that kind of stuff in P S M —L W F Gaines Mich

A Question of Gravity Has Him All Balled Up

Suppose you had two metal balls and the larger one was hollow so that the smaller one would go inside it Suppose the smaller ball could be placed in such a position that their centers of grav ity co ncided Since the force of gravitational attraction between them varies inversely as the square of the distance between their centers of gravity the force of attraction would be practically infinite and the smaller ball would be supported in mid-air This does not seem reasonable to me so could one of your readers point out my mistake in rea soning?—R T S Kirkland Lake Ont Canada



Ship Model Builder Wants More Old Time Vessels

In the past I have greatly enjoyed build ing your ship models such as the *Malek Adhel* and many others I know that Captain McCann has passed on but don t you think that these models of old time ships should be continued?—M E Boston Mass

What We Need, He Believes, Is To Learn How To Live

How many of your readers would be inter ested in a series of articles to comprise a course in inorganic chemistry and qualita tive analysis? Also a similar series on mi croscopy and elementary bacteriology? I certainly think these would be better than all the articles and pictures on war and its adjuncts which appear so promiscuously in all magazines and newspapers now Such a ser es of ar ticles might start some yet unknown person on the road to the discovery of a cure for cancer a new drug to combat tuberculosis new methods of fighting industrial diseases Wouldn t that be better than all the art cles on new bombs dive bombers death rays (?) and so on? What this world needs s more and better schools and teachers hospitals and doctors labora tor es and scientists to help us to learn and live not to die—H W F Bridgewater Mass

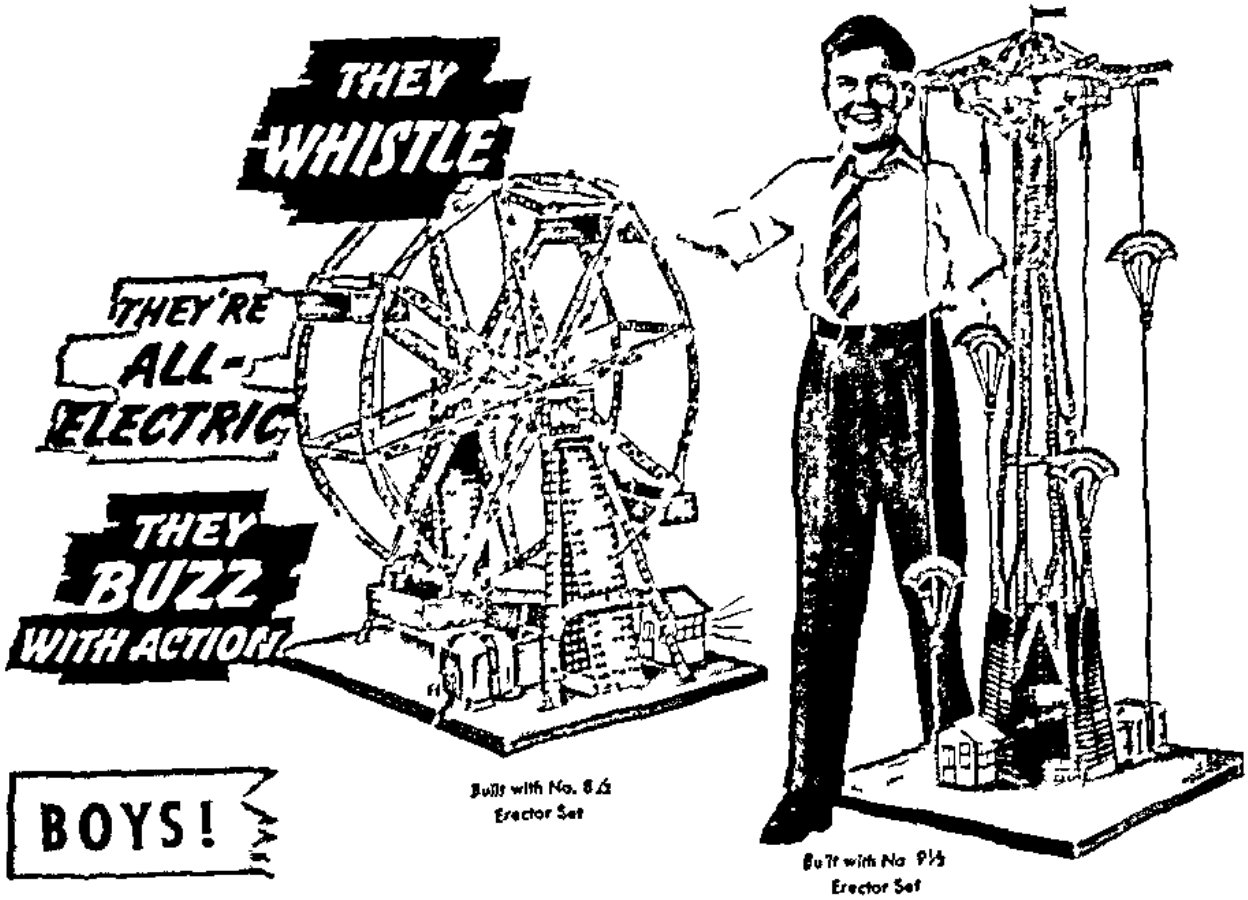


A Plea for a Department on Doing Nothing Efficiently

Your new subject matter grouping of pages with the convenient in dex is another step toward perfection It is observed also that this month brings you (us) a new greatly enlarged Automobile Department Let er come I suggest another improvement by supplementing Our Readers Say with a department of Occu pation for Nothing To-Do People How To Do Nothing Efficiently By the way I read somewhere that during the last six years C C C boys have built 44 000 bridges 110 000 miles



(Continued on page 14)



BOYS!

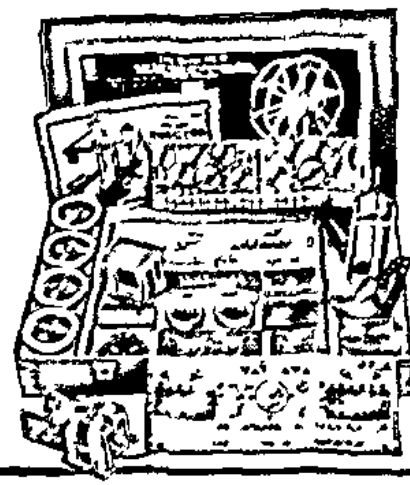
Look at that tower ng Erector parachute jump with electrically illum nated top You bu ld it your self Piece by p ece you fit the long gleaming girders together—attach the parachute rigging—and in stall the powerful Erector revers ng electric engine

And now for thrilling action! Blow your whistle throw your engine into gear and your parachutes are hoisted up and up until they strike the release mechanism Then like a flash they plummet down ward—*unfold—and lazily float to the ground*

Now get a load of that m ghty Ferris wheel It wh stles—tw nkles with l ght—operates in e ther di rection at slow or high speed You can bu ld hun dreds of spectacular real stic mechanical marvels with one Erector set And how the Erector electric eng ne makes them buzz with action! See the new Erectors at your nearest toy store Take Dad along

A C. Gilbert, Founder of the Gilbert Hall of Science the home of Erector American Flyer Trains Gilbert Chemistry Sets Gilbert Microscopes and other Gilbert Scientific Toys

All Electric No 8½ Erector — Crammed with exciting electric features Whistle 110 Volt revers ng electric eng ne with automob le type gear shift Elec tric l ghts Electro magnet so powerful it grabs up steel girders before it touches them Conta ns total of 15 pounds of up to the minute parts for build ing bascule bridge giant *Ferris wheel* magnet c crane oil drill ng rig and many other colossal whis tling engine driven electri *cally l ghted en* g neering mar vels Builds over 100 models Price $12 95 Other Erector Sets from $1 00



The COLOSSAL ALL-ELECTRIC ERECTOR



8 g 24 page illustrated book It s Fun to Be a Boy Eng neer —

Boys gett ng th s book s as exc t ng as go ng to the mov es Over 100 llus trat ons Ma l coupon or post card The A C G lbert Co 606 Erector Square New Haven Conn

Rush b g book (Offer good only in U S A and Canada)

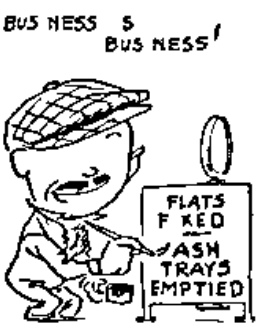
Name
Street
C ty State

Our Readers Say CONTINUED

of roads and 5 200 000 dams Aren t there any C C C girls? If so what have *they* been doing all this time?—H E Mexico City Mexico

Another Solution Would Be To Motorize an Ash Tray

As a solution of the problem of smoking in a car what would you think of a built in ash tray in which the bottom swings out on spring h nges when you press a button allow ng the ashes to go down a pipe and fall on the road? It seems to me that th s would be bet ter than flicking the ashes out the window and gett ng them back in your eye and an improvement over the ash receivers in most cars which can hardly be emptied without dismantling the whole automobile —D J B Chicago Ill



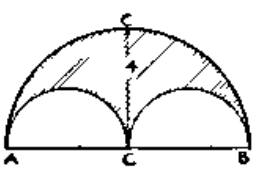
Since P S M Says So, We Must Be Wrong

You state that Sikorsky's new helicopter was the first to make a successful vertical fl ght Maybe so in North America But look back through your files to June 1938 and you will find a photograph of a Focke-Wulfe helicopter being flown by a girl in a German beer garden As you correctly stated this craft was the first to stay in the air for any length of time which an Italian one failed to do It is much more compact than its predecessors or the S korsky machine—B G Halifax N S Canada

B G is right Some day we'll get around to reading th s m agazine of ours —Ed

This Problem in Circles Should Be Easy as Pi

Here s a math problem to help you along All the arcs in the fig ure are semicircles The l ne CD is erected perpend cular to the diameter of the large circle AB at the point of tangency of the two small semicircles The point D is any point on the diameter AB What is the area of the shaded portion of the figure? Use pi equal to 22/7 CD equals fourteen inches —R S K., Chicago Ill.



WHAT S THE AREA OF THE SHADED PORTION?

Gus Wilson Helps Start a Puerto Rico Workshop

When I sent Martin Bunn a little informa tion to use in his Gus and Joe stories I was not expecting to earn any money by it How ever I am very grateful for the five-dollar check for it started my home workshop I used it for the down payment on a bench saw and motor My regular job is as a power plant operator and on the side I act as auto me chanic for neighbors and friends Once in a while I get a queer problem The other day I got one that had me stumped Perhaps you will let me tell you about it some time but I am not expecting to get paid for it Maybe it would show somebody somewhere how to cure this same trouble Wishing Gus Wilson carloads of good luck and many years of fruitful life P S Is Gus married or a bachelor?—R F Isabela Puerto Rico

Gus is a confirmed bachelor As he once remarked Cars are cranky enough but after about twenty years of study a fellow can sort of figure what one of them is going to do next As for women —Ed

Here's One Trick the Enemy Would See Through at Once

Wouldn't it be a help to the United States if we got into a war to make planes out of transparent plastic? Then when you went to bomb the enemy they could hear the motors going but they would see right through the planes The motors controls and bombs would be hard to see up in the sky—W H Miami Fla

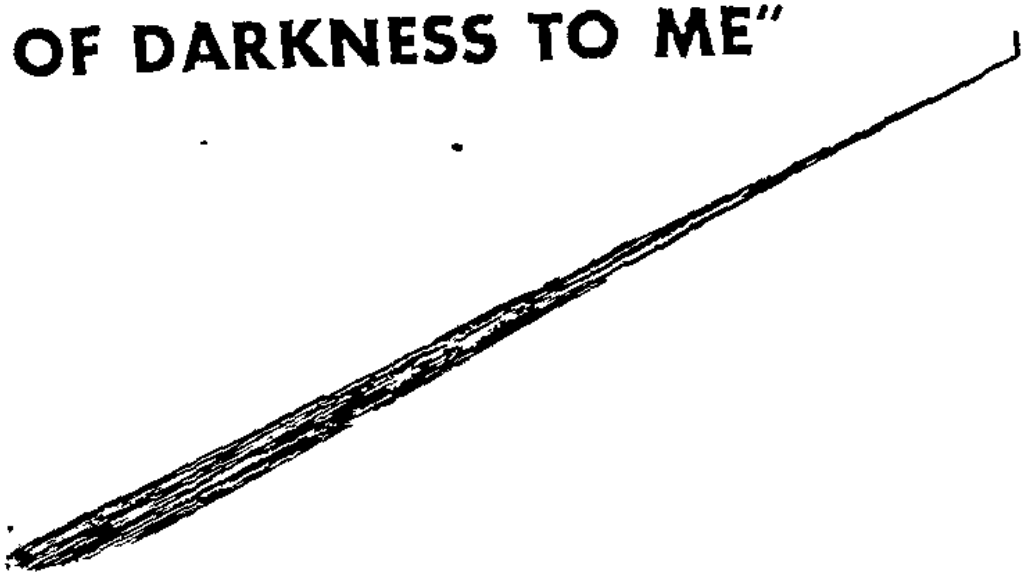


We Got Off on the Wrong Foot With That Corn Razor

For the last five or six years I have noticed a queer instrument in my father s possession When I inquired about it I learned that it was a corn razor Imagine my surprise when I saw it described as a new device in your September issue I don t mean to knock the product because it serves its purpose well What puzzles me is how it happens to appear as something new The one you illustrate is the identical twin of the one my father uses faithfully—J M White Plains N Y

Apparently the razor described in our September issue was not a brand-new invention but an improved product —Ed

"IT WAS LIGHT IN A WILDERNESS OF DARKNESS TO ME"



"I was stuck. A wife and three kiddies — and the same old pay envelope. I couldn't see a thing ahead except the same old grind. Then one day I read an I. C. S. ad. The coupon fascinated me. A new idea struck home — it was light in a wilderness of darkness to me! Today, because I mailed that coupon two years ago, I am a trained man — making a trained man's pay!"

Nearly fifty years ago, the International Correspondence Schools were established to provide sound educational facilities to men unable to attend resident schools. Over five million dollars has been spent in preparing textbooks and keeping them up to date. Today, you'll find I. C. S. graduates holding leading positions in every field of business and industry.

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★ Without cost or obligation, please send me a copy of your booklet, "Who Wins and Why," and full particulars about the course *before* which I have marked X: ★

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☐ Sanitary Engineering
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☐ French ☐ Grade School
☐ High School ☐ Illustrating
☐ Lettering Show Cards
☐ Managing Men at Work
☐ Railway Postal Clerk
☐ Salesmanship
☐ Secretarial
☐ Sign Lettering ☐ Spanish
☐ Traffic Management

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☐ Tea Room and Cafeteria Management, Catering

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City..... State..... Present Position.....

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British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England

Helps for the Home Owner



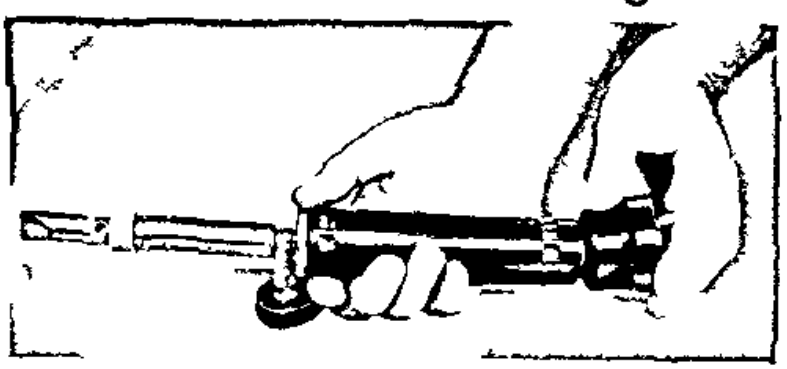
Apply ng l noleum cove ng to a wall Open ngs fo sw tches and othe wall p o ect ons a e cut out of the mate al as n us ng wall pape

Wall Covering of Linoleum Now Available

LINOLEUM long used for floor coverings is now be ng employed for covering the walls of bathrooms k tchens and playrooms w th a wide selection of patterns and colors ava lable The covering s except onally easy to apply A strong adhes ve base is first brushed onto the wall to be surfaced and the li noleum then rolled into place over t as shown in the photograph at the left Open ngs for l ght switches and other wall project ons are cut out with a sharp heavy knife Being completely waterproof linoleum walls can be thoroughly scrubbed and washed when they become soiled without any possib l ty of damage to the surface Furthermore since they are fadeproof they are not affected by exposure to strong sunl ght The material makes decora t ve effects poss ble in rooms where wall paper would not be practical

Single Unit Combines Blowtorch and Soldering Iron

BLO TORCH and soldering iron are combined in one un t now avaïlable to home repa rmen E ther gasoline benzine or denatured alcohol may be used as fuel for the blowtorch whose concen trated flame heats up the un t s soldering po nt within three m nutes The torch regulating valve at the end of the un t serves also as a stand for the soldering iron when it is not in use



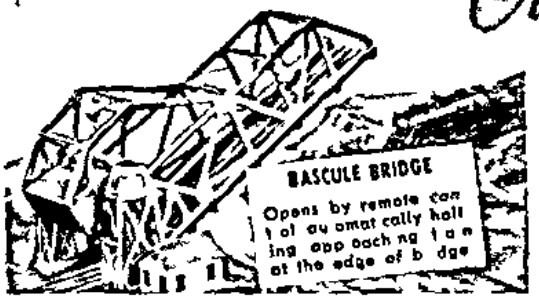
Concent ated flame f om the blowto ch n the handle heats the sol der ng on po nt The flame egulat ng valve serves as the rest



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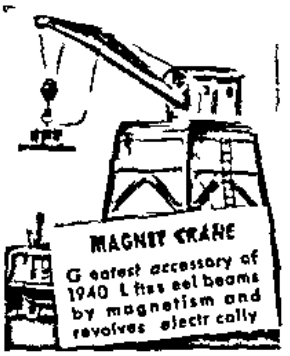
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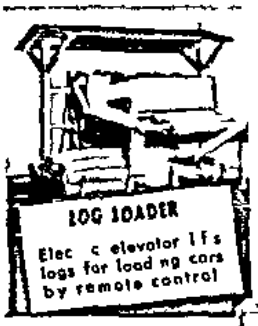
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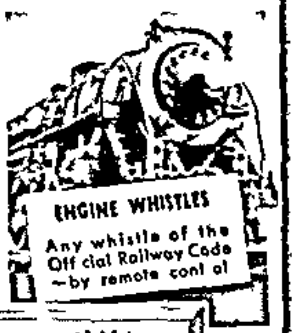
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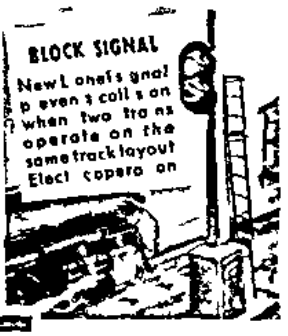
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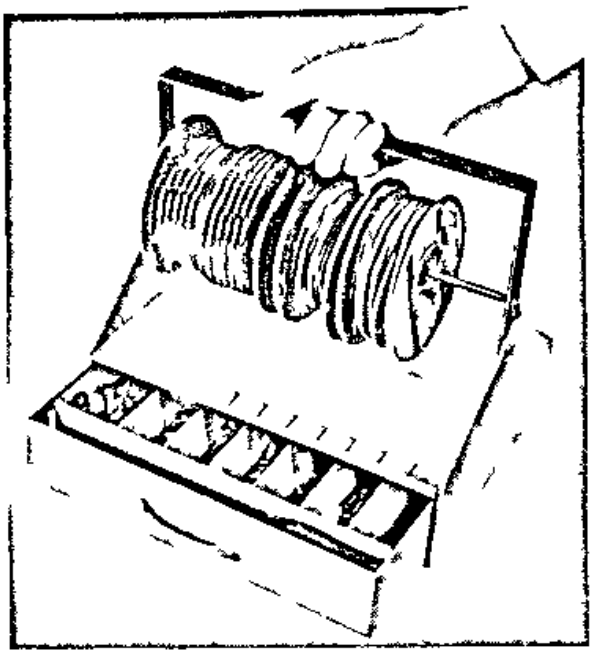
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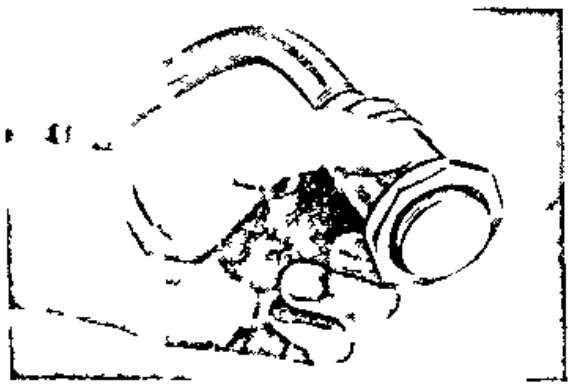
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Portable Electric Repair Kit Holds Tools, Wires, Parts

ELECTRICAL work around the home should be made easier by the portable wiring kit pictured above Spools for wire are mounted on top of the metal kit box, which contains a drawer of compartments for screws insulating materials and other small wiring parts A twelve inch rule is marked along the edge of the case just above the drawer

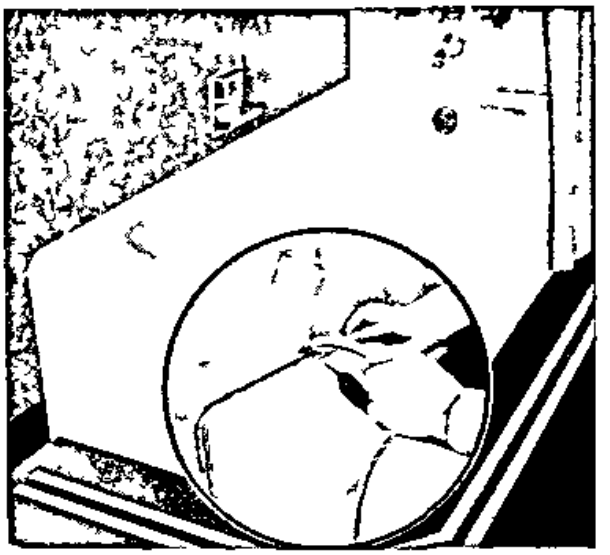


Circular-Spray Shower Head Takes Less Water Pressure

BECAUSE it requires less water pressure to provide an adequate soft spray a new shower head effects a saving in the amount of water used No small holes are used water squirting out around the sides of the shower head face in a controlled circular stream A ball joint allows the head to be adjusted to various angles

Rubber Molding Seals Edges of Built-In Bathtubs

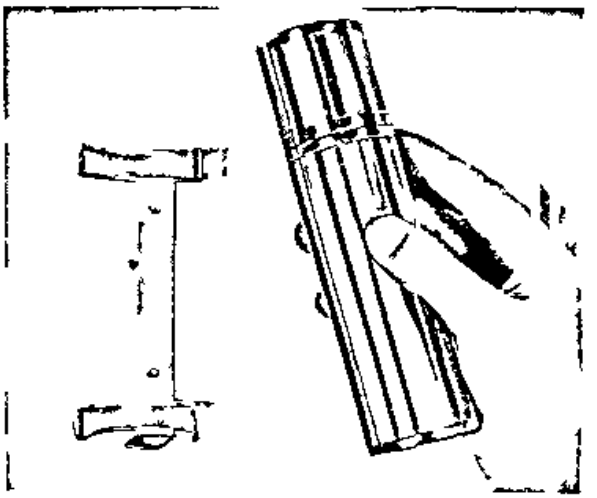
PERMANENT water tight and decorative rubber molding in strip form is now marketed for sealing the joint between a built in bathtub and the adjacent wall The molding which is flexible to follow the contour of the tub is made of sponge rubber faced with solid rubber that is not affected by soap or hot water



Built in tub with rubber molding along the wall joints Inset shows how the material is applied

Midget Fire Extinguisher Is Handy for Home or Car

A FLASH LIGHT SIZE fire extinguisher only six inches long is now offered to home owners Sold complete with a tubular case and wall bracket the unit has put out small oil kerosene and gasoline fires within fifteen seconds in tests Breaking a metal tip puts the extinguisher in operation



INVENTORS

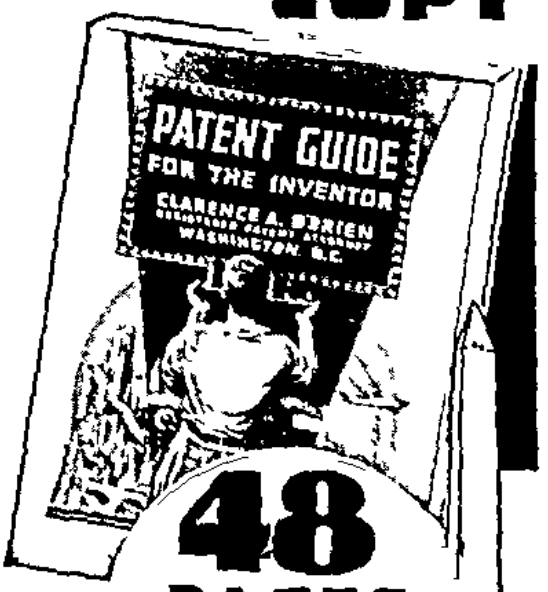
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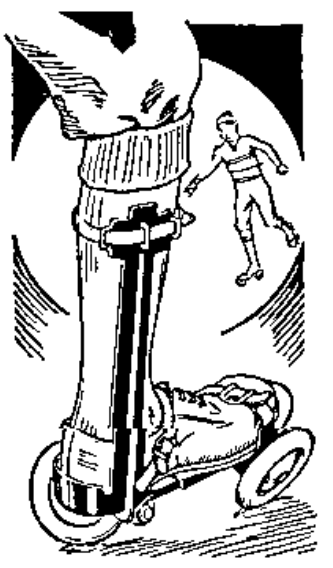
With the Inventors

(Continued from page 20)

conventional hearing aids Tiny batteries that operate the device are installed within the bows of the glasses TO PROVIDE SKIERS with a way to obtain better control on downhill runs Hans Thirring, an Austrian inventor, has patented the odd ski sails shown in the illustration Made of balloon silk, sail-



cloth, or a similar material the sails are cut so that the lower ends can be fastened to the ankles of the skier by means of loops and elastic straps At the upper edge the sail is turned back to form sleeves, into which the skier places his arms When running down an exceptionally steep slope, the skier can spread out his arms and let the wind enter the bellied sail which then will act as a wind *brake to slow him down to a safe speed The* sail may also be used as an aid in turning to one side or the other ONLY TWO WHEELS are used on a roller skate patented by William H Decker, of Shawnee, Okla Each skate has one rubber-tired wheel placed at the front and on the outside of the foot, and a second wheel placed at the rear and on the inside of the foot According to the inventor, this arrangement makes it easy for the skater to change the direction of his travel, and since the wheels are rubber tired and considerably larger than conventional wheels, skating over rough surfaces is possible without greatly affecting the skater's balance or causing him to fall The skates are steadied by a vertical steel brace which is strapped

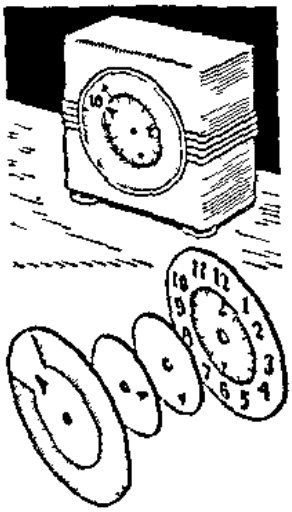


(Continued on page 23)

With the Inventors

(Continued from page 22)

to the outside of the skater s leg NATHAN HAMMER of New York City is responsible for a novel clock which has no hands The timepiece utilizes four dials placed one over the other, and all moved by the same clockwork mechanism The outside dial trans parent except for an opaque ring around the outside that has one transparent open ing is used to indi cate the hour The second dial contains an opaque arrow which indicates the minute and the third dial has an opaque arrow that indicates the second The fourth dial is marked with hour numerals around its outside rim and minute and second markings nearer the center



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a cable to tension springs installed in the garage By the time the car is in position on the turntable, enough energy has been stored in the springs to spin the platform around Before being used again it is returned to its original position by hand

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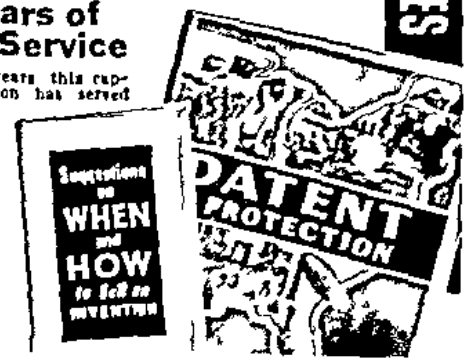
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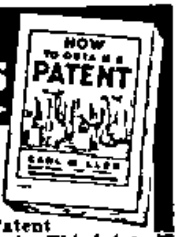
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2S	U S Navy destroyer PRESTON 31½" long	5 95*

(Continued on page 26)



Scale model of an Early Colonial kitchen assembled with Kit 13 It is 21" long 7" high, and 5 deep

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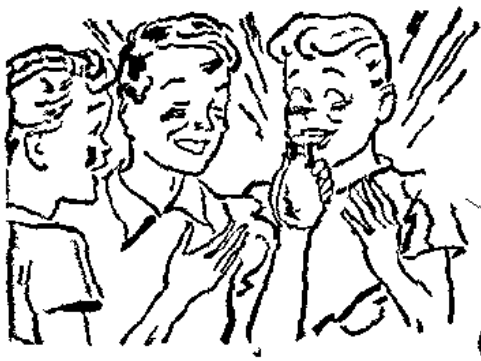
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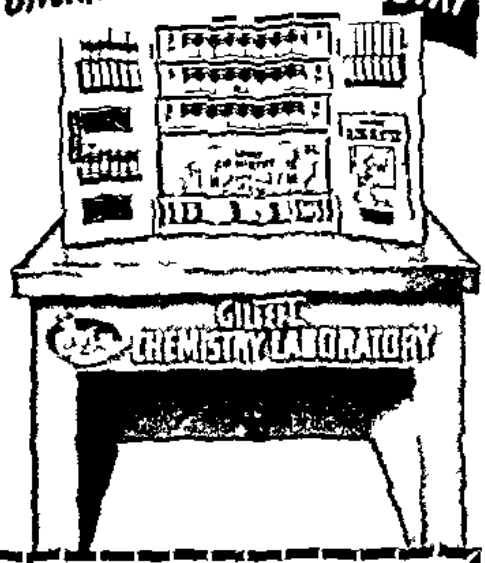
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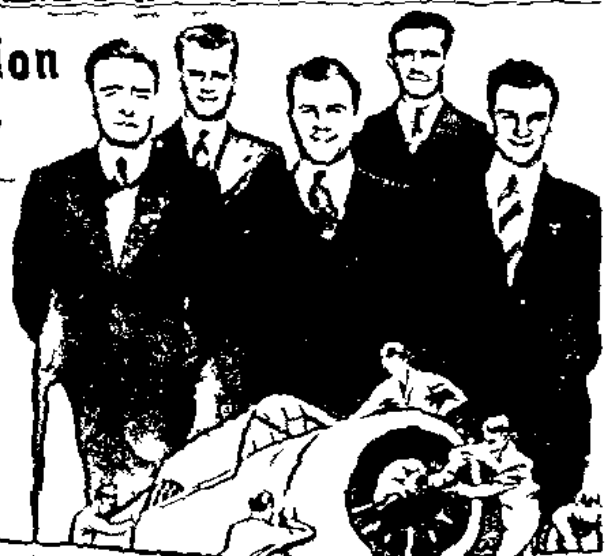
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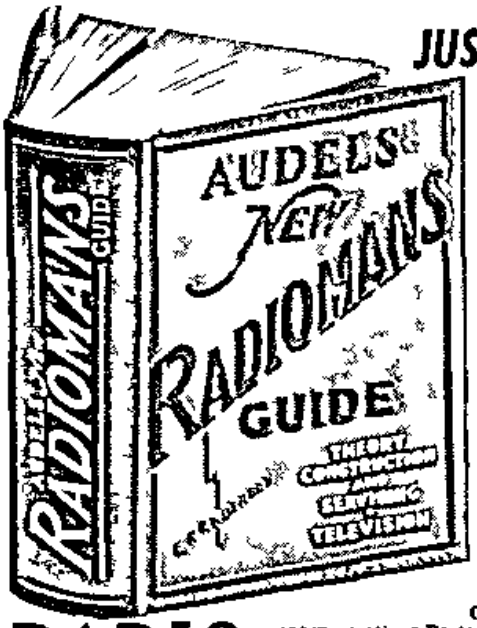
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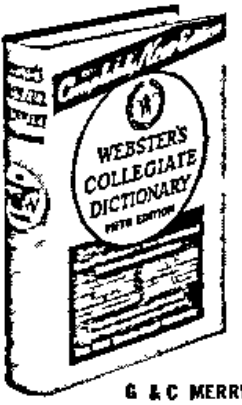
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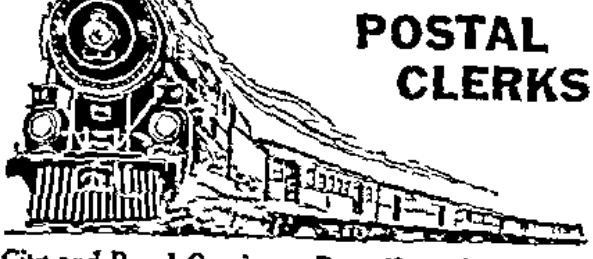


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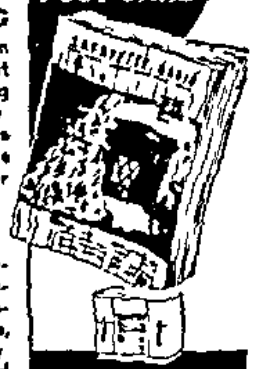
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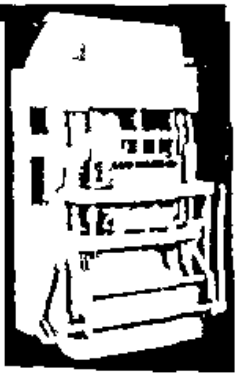
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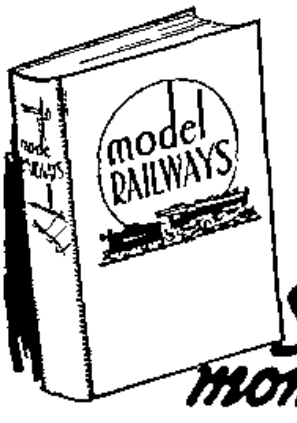
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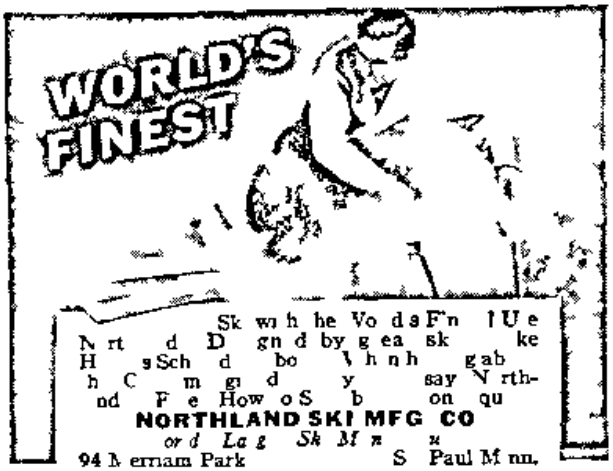
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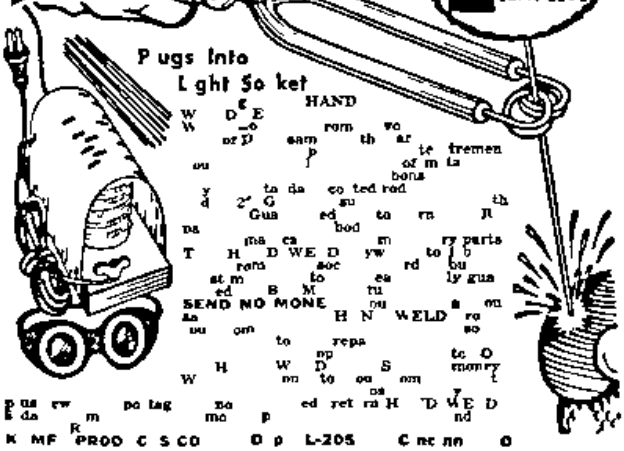


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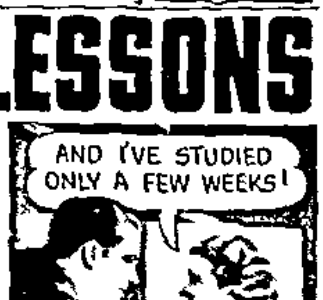
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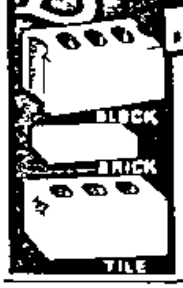
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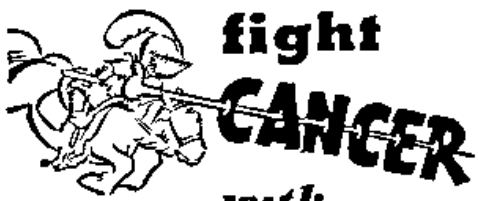


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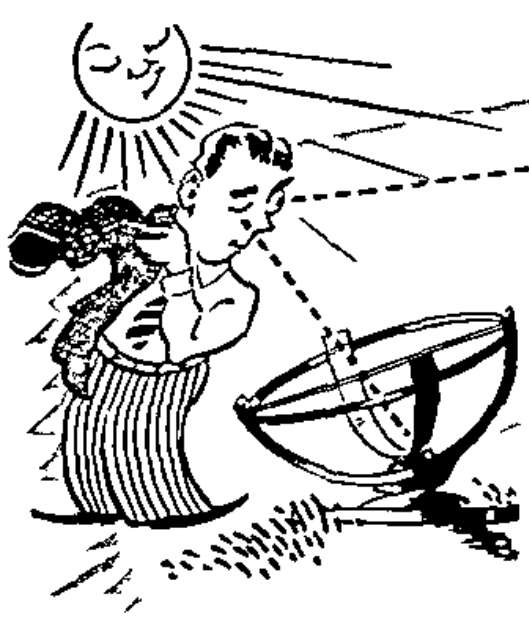
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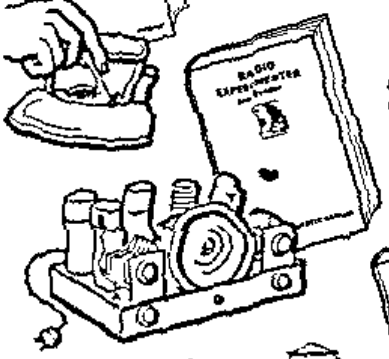
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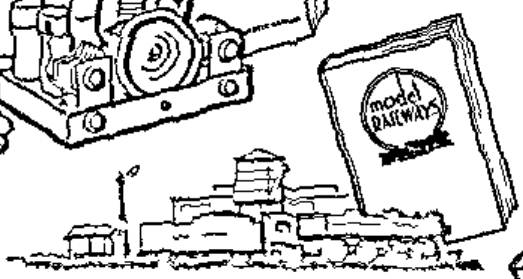
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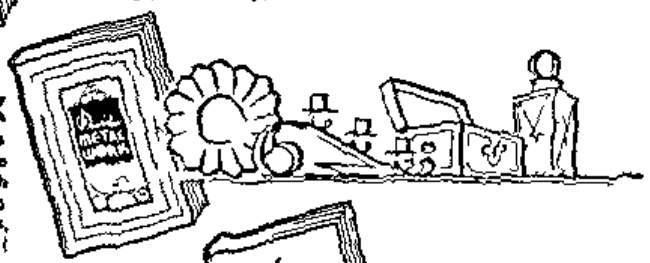
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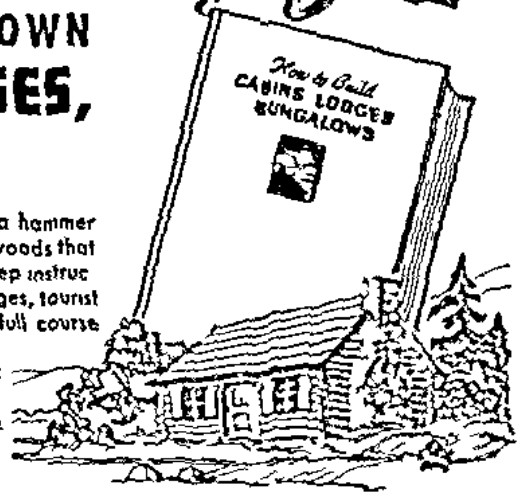
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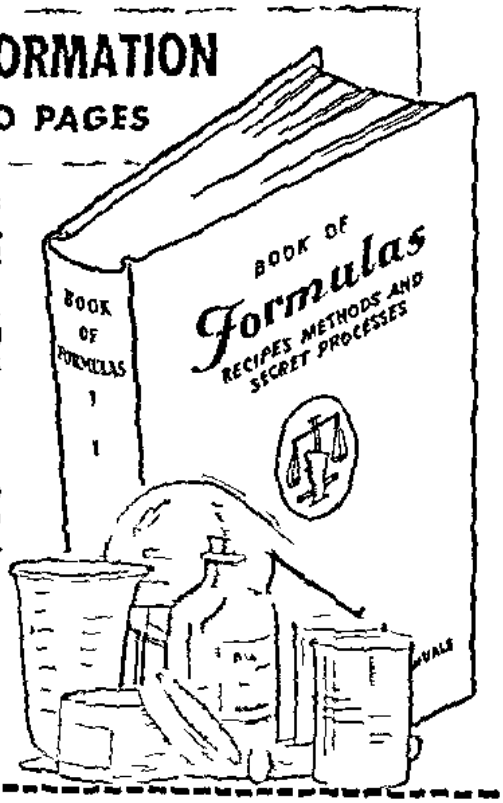
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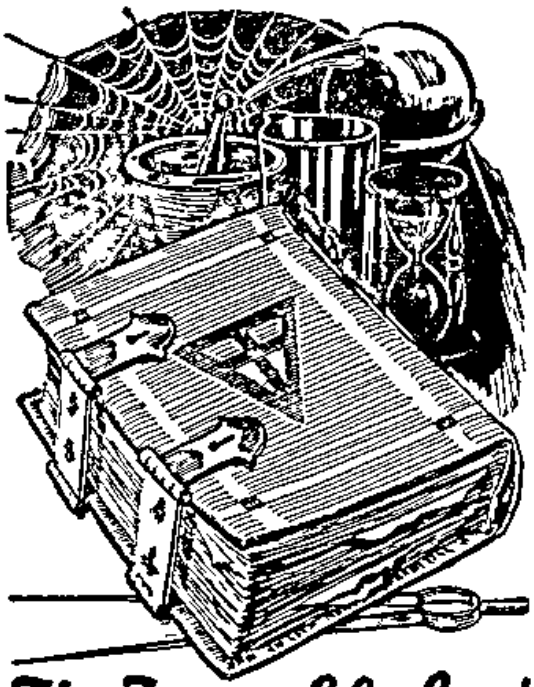
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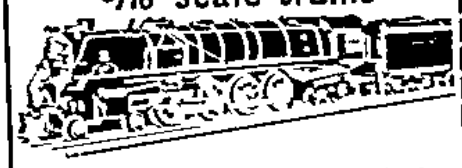
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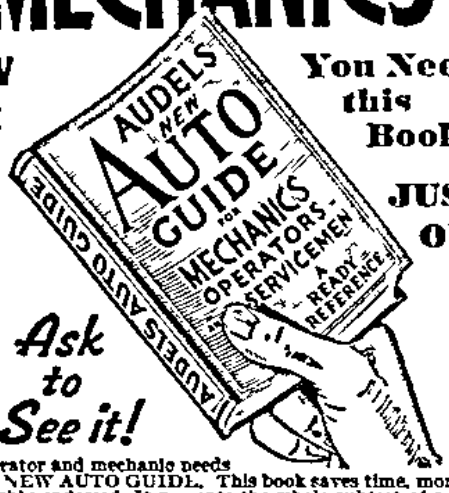


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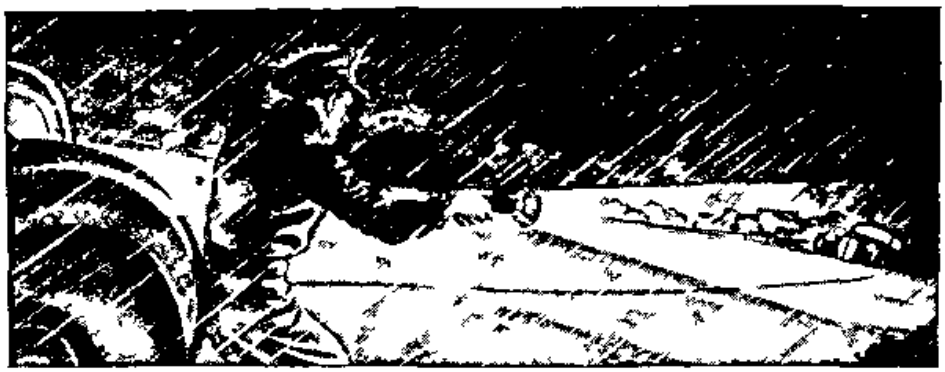
WITH SIGHTLESS EYES I GUIDED 10 TONS OF DESTRUCTION!



As told to JOHN FENIMORE *St Louis Missouri*



THE RAIN WAS COMING DOWN in buckets as I took my heavy transport truck down a long hill, writes Mr Fenimore. Suddenly I thought the end of the world had come Lightning had blasted the road a few feet ahead of my truck!

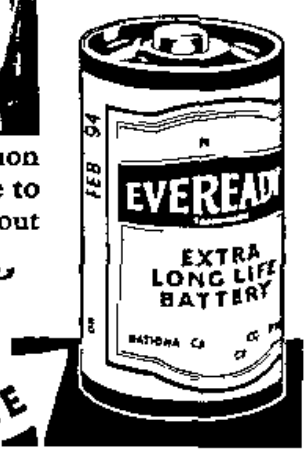


THE BOLT BLINDED ME but somehow I managed to bring that 10 ton truck to a stop I groped in the darkness for my flashlight then stood by the truck and flashed an appeal for help



I WAS PICKED UP and rushed to a hospital where prompt medical attention saved my eyesight. That I enjoy the blessing of normal vision today is due to Eveready *fresh* DATED batteries You can bet I'm never going to be without them!

(Signed) John E Fenimore



The word "Eveready" is a registered trade-mark of National Carbon Co Inc

FRESH BATTERIES LAST LONGER.. *Look for the* DATE-LINE

NATIONAL CARBON COMPANY INC 30 EAST 42nd STREET NEW YORK N Y

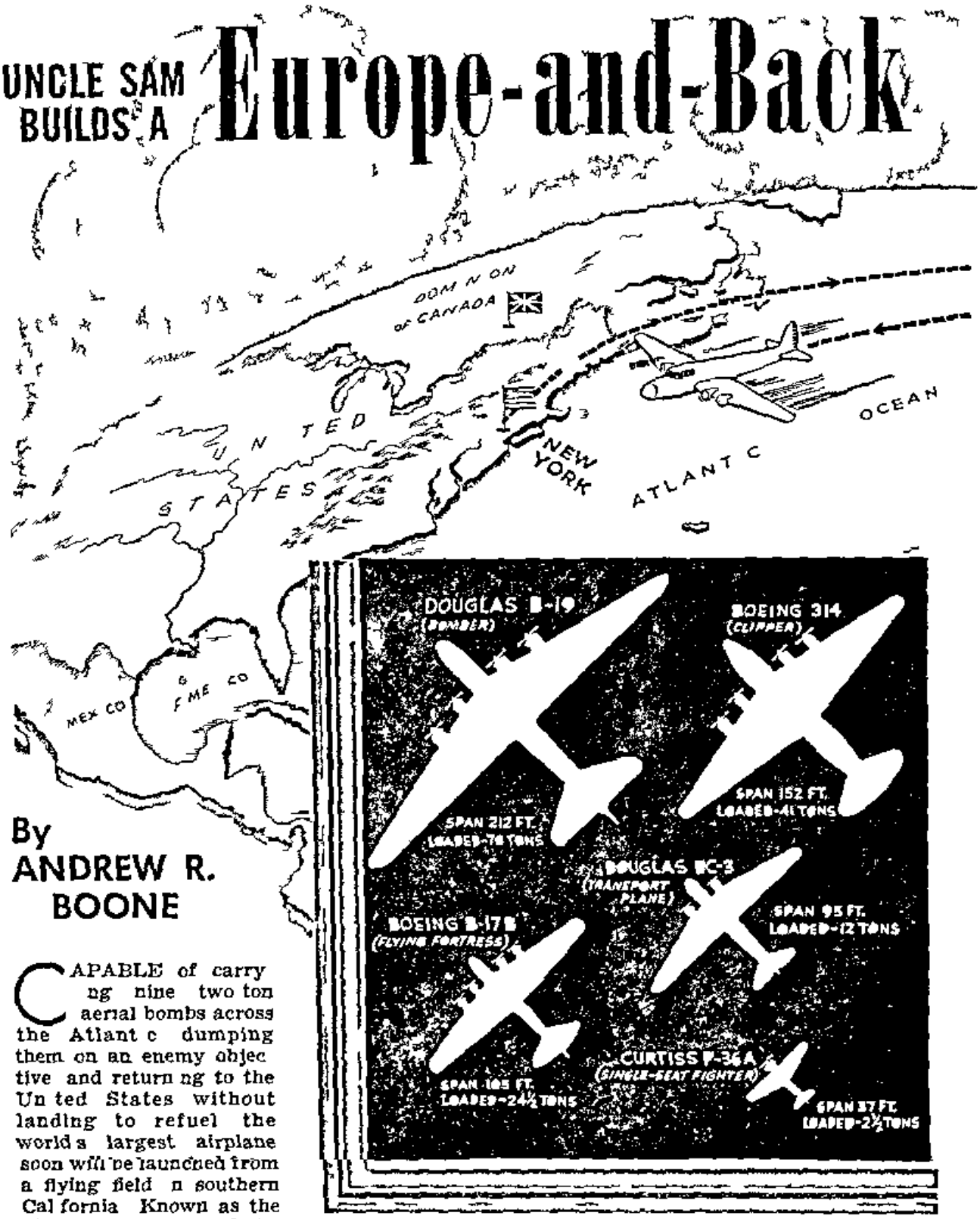
Unit of Union Carbide UCC *and Carbon Corporation*



The MEN of the Month

Wealth and a famous father are two stumbling blocks in the way of success At least that was the short pants not on of Edward R Stettinius Jr For Little Stet as University of Virginia classmates tagged him swapped his college blazer for the grimy overalls of a forty cent an hour General Motors laborer And his not on must have been right for just seven years later the motor moguls lettered "Vice-President on his office door And seven years after that the white-haired black browed stripling of thirty seven startled the industrial world by becoming head of one of the largest corporations on earth U S Steel Now at forty he has tossed aside that $100 000 job and is collecting his dollar a year providing the mountains of raw materials necessary to satisfy the monstrous appetites of the thousands of factories that are grinding out guns tanks and planes for national defense Whether slashing red tape in Washington or calmly discussing the health of Hereford cattle or Belgian draft horses on his Virginia farm Little Stet constantly exhibits his amazing genius for getting all types of men to pull together in a common cause

UNCLE SAM BUILDS A Europe-and-Back



By ANDREW R. BOONE

CAPABLE of carrying nine two ton aerial bombs across the Atlantic dumping them on an enemy objective and returning to the United States without landing to refuel the world's largest airplane soon will be launched from a flying field in southern California. Known as the U. S. Army Douglas B-19 the long range bomber can climb with its eighteen ton lethal load to an altitude of 22,000 feet and speed through the sky at 210 miles an hour. Its wing spreads 212 feet from tip to tip and four 2,000 horse power radial engines turning sixteen foot three blade propellers will give it more power than ever before has been supplied to an airplane either military or transport.

For four years 500 engineers and mechanics have worked secretly at designing the big ship and constructing its parts. Recently working with clocklike precision from a carefully checked script, they guided the gigantic structure from the maze of steel girders in which it was fabricated

Warplane



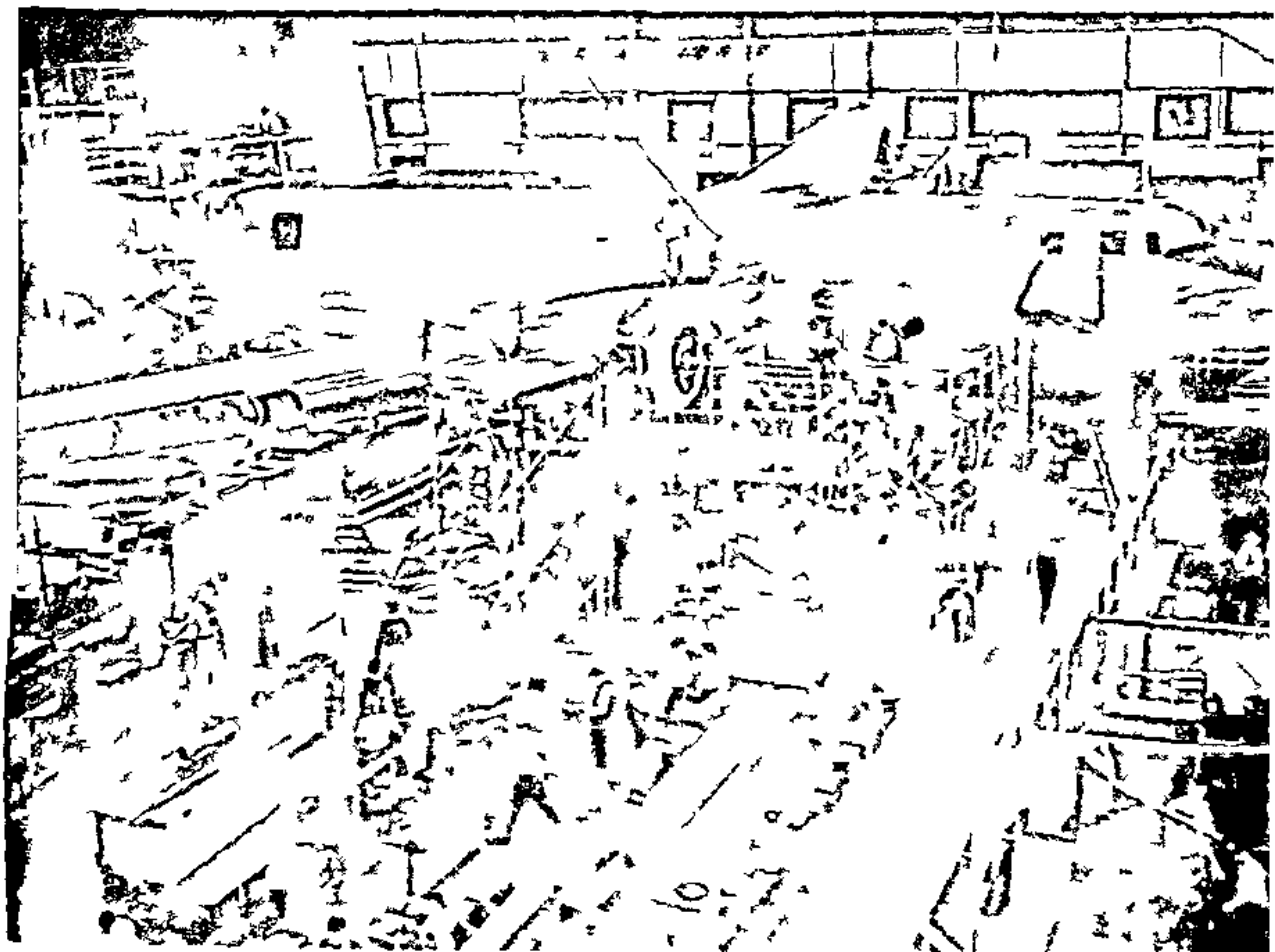


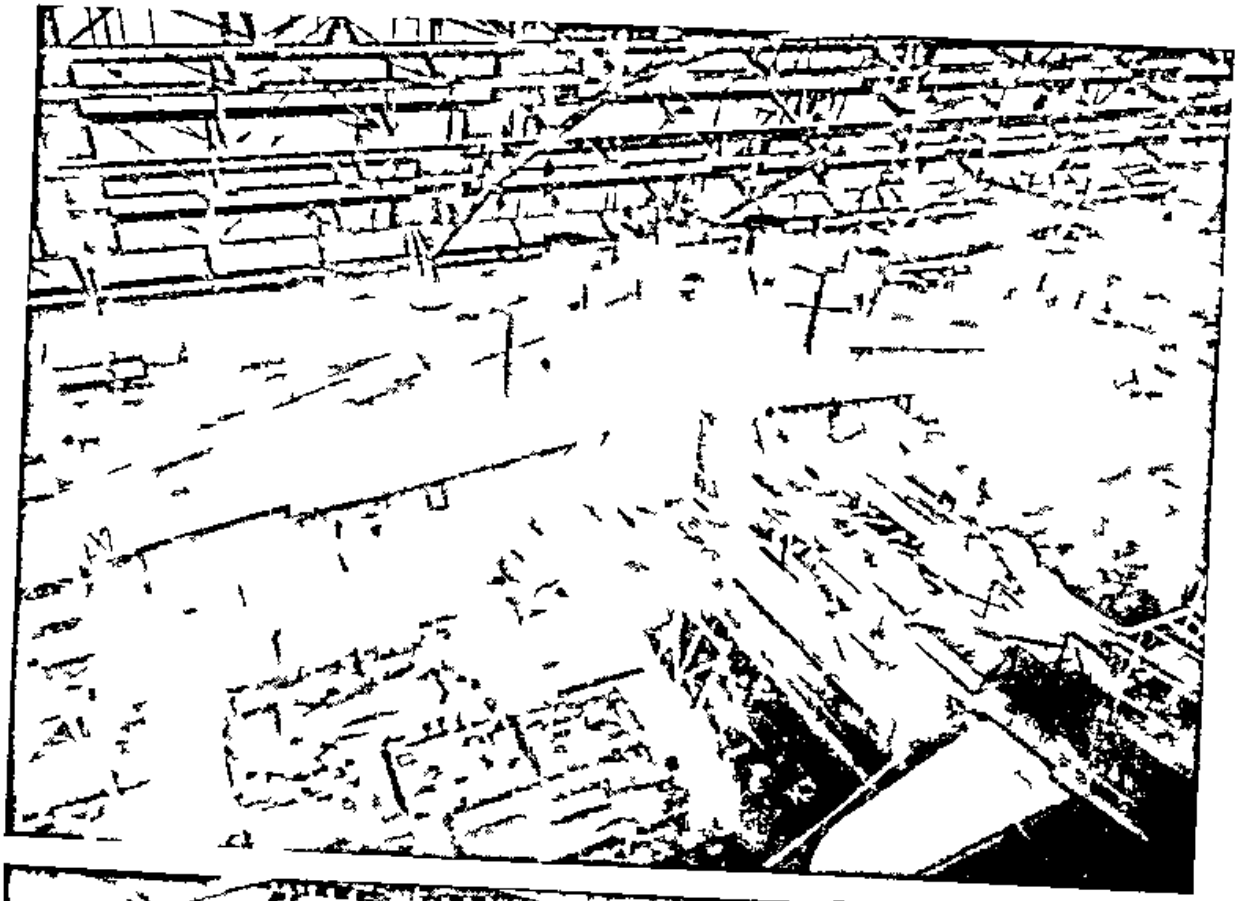
Assembl ng the lead ng edge of a 212 foot w ng held n a g r s ng s xty feet f om the floor

and gently turned the fuselage and wing from a vertical to a horizontal position When the engines are installed and gasoline poured into the wings a crew of ten will test fly the new leviathan It will have a total weight fully loaded of 140 000 pounds

In building the new weapon of the sky engineers concentrated on range and strik ing power rather than on speed Including a tricycle landing gear and a retractable nose wheel the ship is constructed entirely of metal Its wheels eight feet in diameter will disappear during flight in huge wells under the wing The ship measures 135 feet from nose to tail and the tail assembly stands as tall as a three story building Towering forty two feet above the earth the fin alone has an area larger than the

The U S Army s B 19 world s b ggest a rplane takes shape in the huge Douglas factory n Cal forn a







Fuselage and w ngs we e fab r cated n a ve t cal pos t on am d a maze of g de s Below mechan cs at wo k n the oomy cockp t connect ng the many cont ol cables

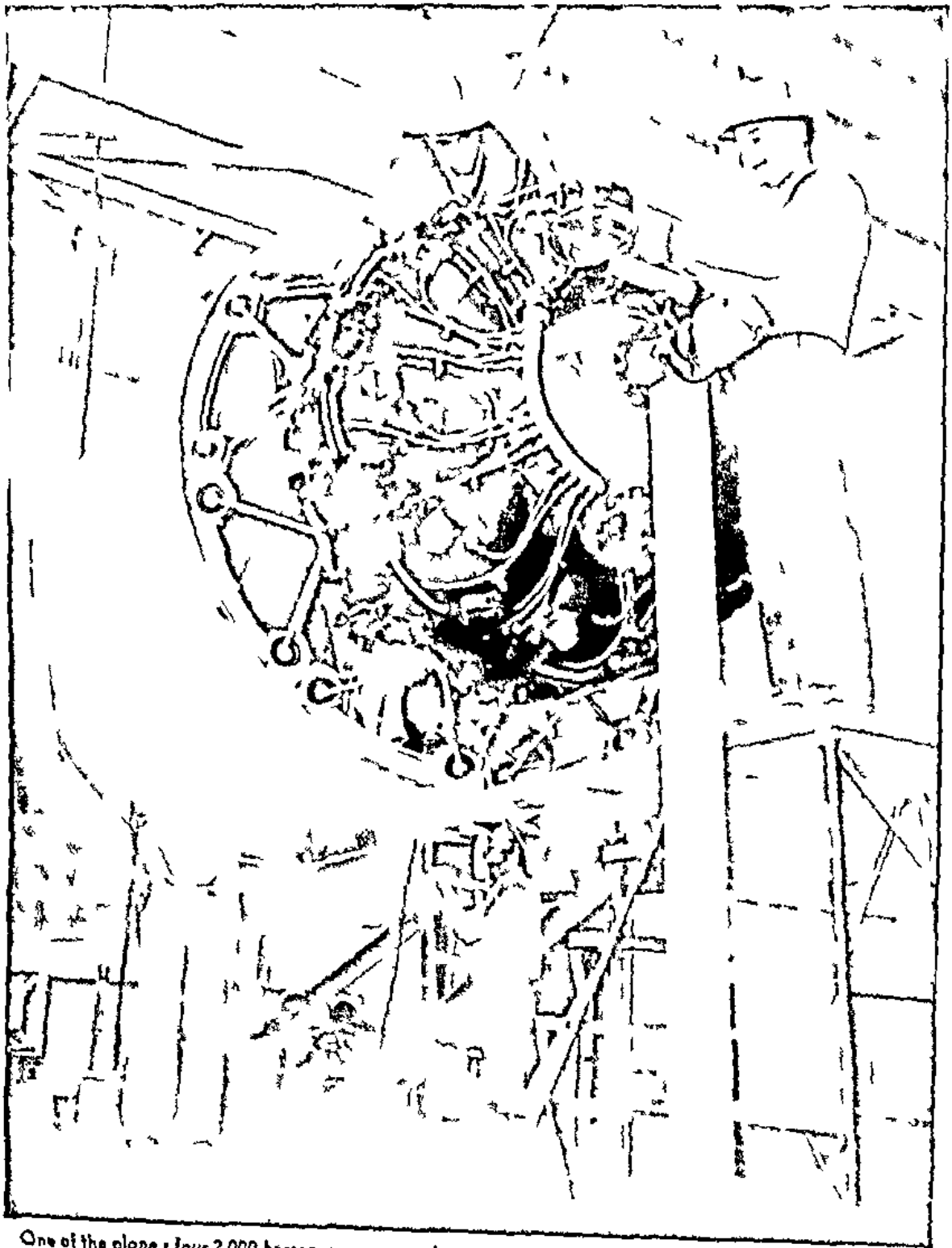
wings of the large twin engine transports operating on the nation s air lines

All the huge load of fuel required to drive the mam moth bomber on its long range flights will be carried in the wings in self sealing cells that will prevent ex cess ve loss of gasoline if the wing is punctured by bullets or shells Baffles in s de the fuel tanks keep the liqu d from splashing about.

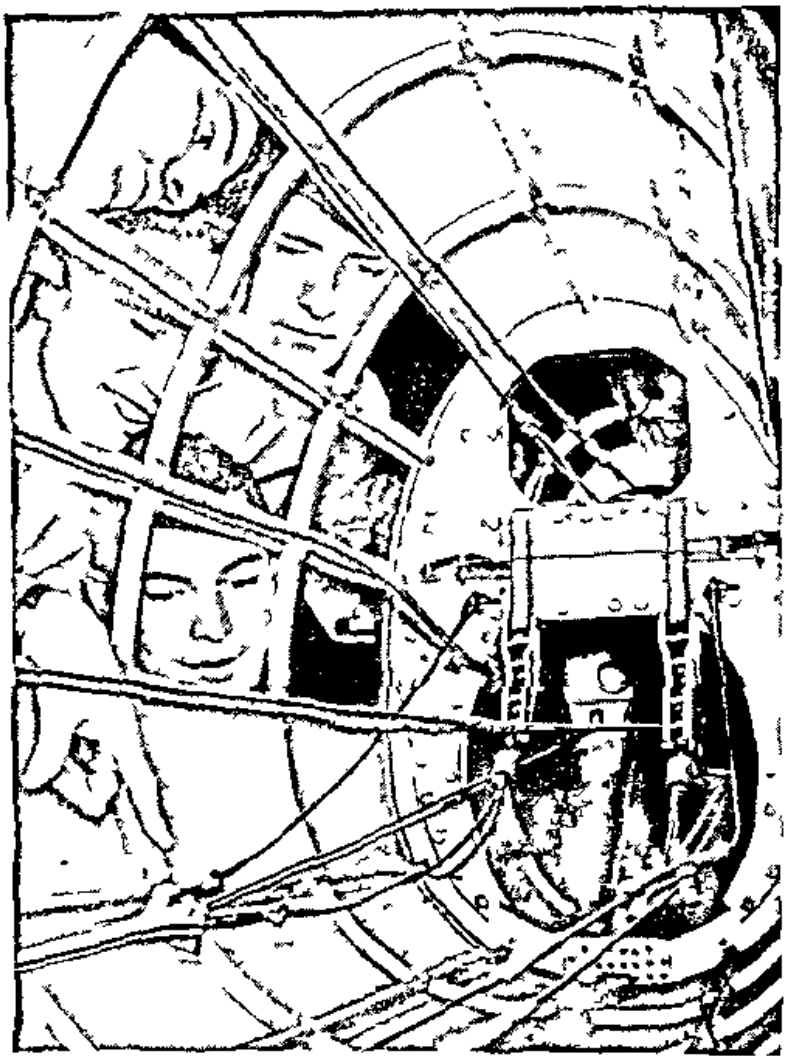
Under certain cond tions of weather and load the plane will have a range of 7 750 miles Bristling with cannons and mach ne guns it will be the most formida ble fortress of the air ever designed. When taken over by the U S Air Corps in a few months the B 19 will be used as a laboratory for

assembling and checking tactical and structural information from which may be developed large cargo and troop transports for the future

Just as the Army's pioneering with the Flying Fortress paved the way for the development of the mammoth four engined stratoliners so the construction of the B-19 may blaze the trail for larger commercial sky liners. It may not be long before a plane like the B-19 will be carrying passengers across the Atlantic. Already Pan American Airways is planning an ocean service with seventy ton 150 passenger ships. In the conquest of the air wings of peace follow the wings of war



One of the plane's four 2,000-horsepower engines being mounted in a dummy wing section for cooling tests



Randolph Field flying cadets studying their subject at first hand

Army Flying Cadets See Plane Structure Through Open Panel

CUT away to reveal its interior mechanism, a fuselage of a big twin-motored plane helps train future Army flyers at Randolph Field Texas Through windows made by removing sections of the metal covering from the ribs, a clear view may be had of all the intricate control cables and wiring that go into a modern fighting craft By first-hand study, under the direction of an experienced instructor, the flying cadets quickly familiarize themselves with the purpose, appearance and mechanical design of each essential fitting which out of sight during flight, nevertheless performs vital functions in control, operation, and performance of the giant aircraft The illustration at left shows a group of them peering through the bared ribs to find out, with the aid of the windowed section, what makes a plane work

Mobile Air-Line Ticket Office Rides in Auto Trailer

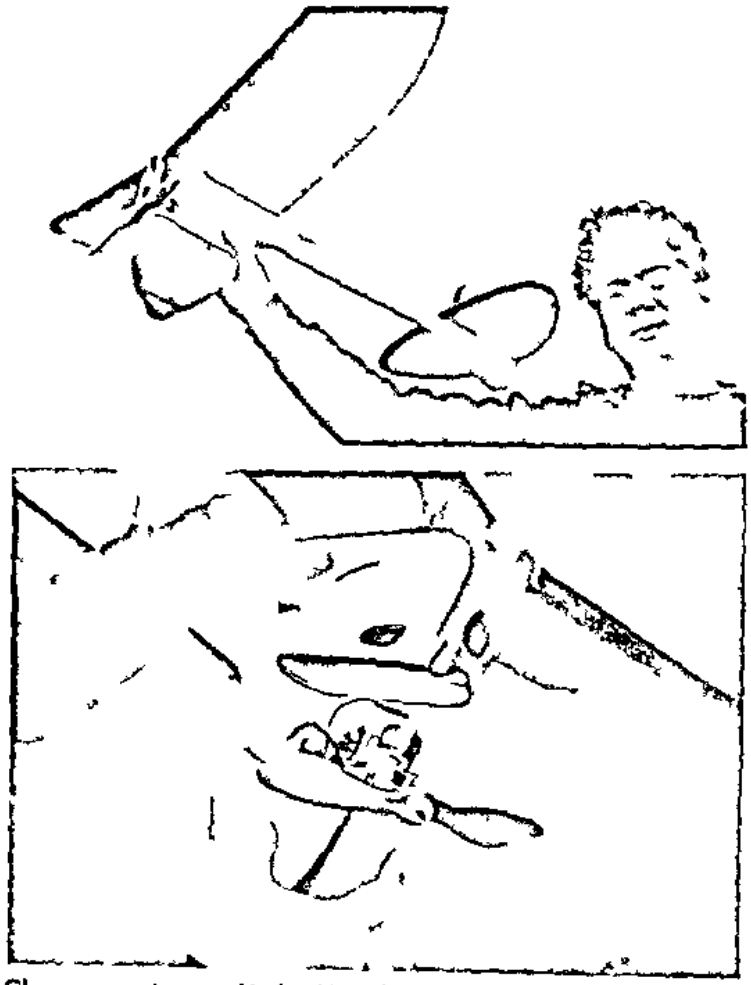
SET up in an auto trailer and towed across country a mobile air line ticket office operated by Eastern Air Lines served travelers during the presidential campaign Those who made special trips to Elwood, Ind, to hear Wendell L. Willkie s speech accepting the Republican nomination, found the office parked at the scene as shown below Stepping inside the door of the trailer where a completely equipped information depart ment and ticket office were set up, they could obtain reservations for plane travel



Eastern Air Lines s rolling ticket office It can be towed anywhere to meet a rush of air travel

Spare Motor for Model Plane Is Installed in a Jiffy

IF THE motor of his model plane balks during a competition Michael Beechman New York fan doesn't care He simply detaches an under section containing the tiny gasoline engine and substitutes a spare Ingenious design makes the power plants so readily interchangeable that only a few seconds time is required According to the young designer the innovation does not interfere with the flying qualities of the plane which lands upon a wheel at the bottom of the removable unit. Because of its shape the builder calls it a hatchet plane



Changing motors on Michael Beechman's gas powered model plane is as easy as this In the upper picture the builder is seen with the model ready for flight Note the landing wheel at the bottom

Airplanes May Get Hydraulic Drive

HYDRAULIC drive recently introduced in automobiles is applied to airplanes in an invention by Charles Adler Jr of Baltimore Md Pumps operated by the plane's engines force a fluid such as glycerin or light oil through pipes to turn turbinelike motors connected to the propeller If one engine fails all propellers can still be kept spinning



More power to our planes the new eighteen cylinder Wright engine

Air-Cooled Engine Hits New Mark of 2,000 Horsepower

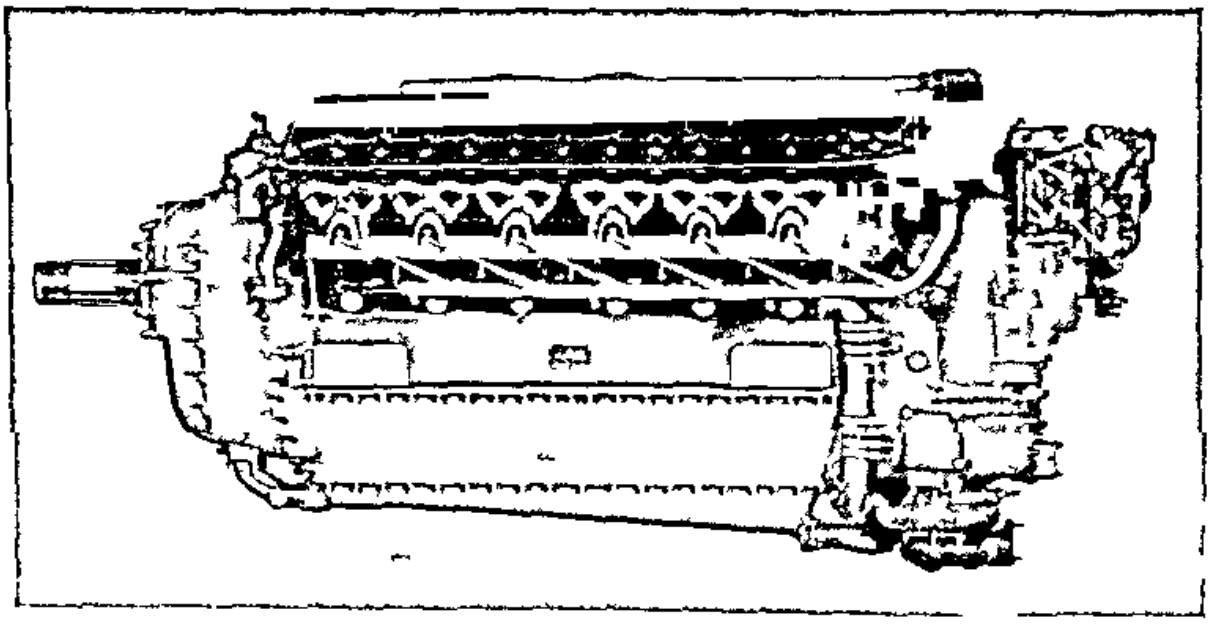
CALLED the world's mightiest air cooled motor for planes the eighteen cylinder giant at left marks a new advance in the quest for greater power Four of these 2 000-horsepower Wright Cyclones will propel the enormous seventy ton Douglas bomber under construction (page 56) Meanwhile secret experiments are reported under way with a liquid cooled 4 000 horsepower motor of forty two cylinders

STREAMLINE MOTORS for Streamline Warplanes

CONDENSED FROM FORTUNE JULY 1940

HERE and there in the United States like gangl a in a vast nervous system factories are working at top speed in the production of power plants The world is fighting a war of motors The explos ons in engine cylinders have become as important as the explosions in cannons and machine guns The quick production of bigger and better engines for planes and tanks is a front page problem of the day

The more significant of these two engines of war is the motor used to power pursuit planes and bombers the combatant and striking arms of the air force Because of the great speed required in aerial tactics motors for warplanes are now generally of 1 000 horsepower or more In th s country there are three manufacturers of such en g nes that are now on a production basis Two—Pratt and Whitney and Wright—are established manufacturers of high power radial motors By December each will be turning out 900 of these air cooled power plants a month The third is the Allison Di vis on of General Motors at Indianapolis which makes the Allison liqu d cooled mo tor ranging from a twelve cylinder job rated at 1 090 take off horsepower to a twenty four cylinder job now in the ex perimental stage tentatively rated at 2 300 The company sometimes ships as many as four or five engines a day sometimes less This winter when its present production plant will have been doubled the manage ment expects it will be turning out 100 en gines a week or 5 200 a year The engine has already been accepted as the power plant for the Curtiss P-40 and the Bell P 39 (Airacobra) both single engine pursuits



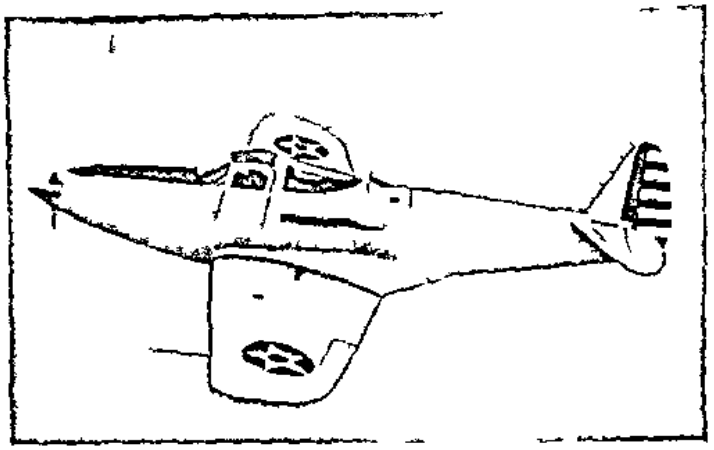
Th s is the All son l quid cooled a rplane eng ne accepted power plant for several lead ng types of f ght ng craft It enables des gners to bu ld more speed and maneuverab l ty into warplanes

the Bell FM 1 (Airacuda) a twin engine multi place fighter the Bell XFL-1 (Airabonita) a Navy single engine fighter and the Lockheed P 38 a twin engine interceptor This acceptance was based on a model test applied by the Government to motors made in the experimental shop The Allison has yet to pass the pro duction type test which is ap plied to the engine made in quan tity in the factory

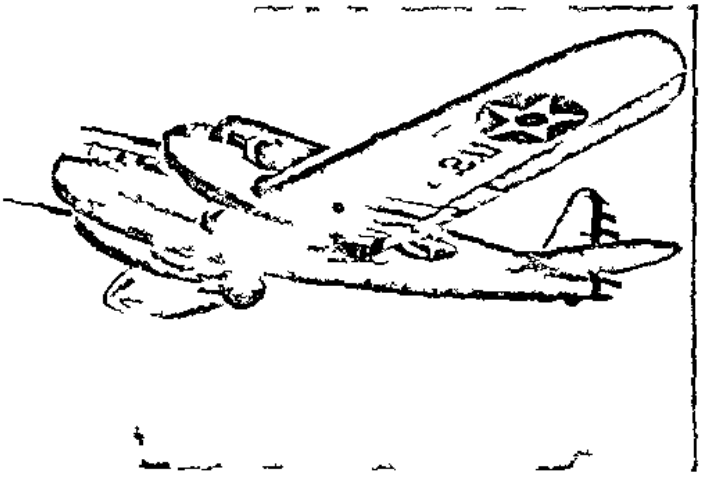
If the production of Allison en gines meets the managers ex pectations the country s annual rate of production of high pow ered engines will be about 27 000 Th s will be enough to power 18 000 planes for one engine should be held in reserve for every two in service How ever since many models will need either two or four engines the number of planes will be about 12 000

One of the reasons why the Government looks w th hope at the Allison engine is that h gh powered motors up to no v have been put out by companies spe cializing in their manufacture Allison however is an engine controlled and sponsored by Gen eral Motors a fact that has caused the governmental and pop ular bel ef that the industry is now going to achieve mass pro duction This suppos tion has been based partly on the further fact that Allison in a way is a descendant of the Liberty engine of World War I a mass produced motor of 400 horsepower

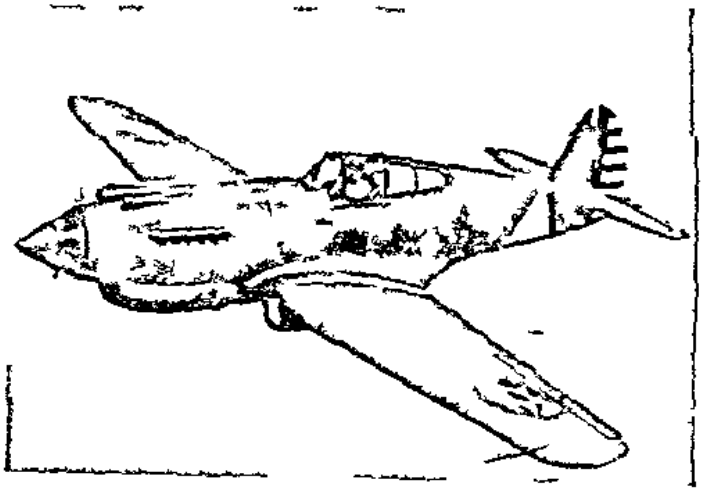
However there is a great dif ference betw een the effort of 1917 and the effort of 1940 The Lib erty engine failed as a military weapon abroad ch efly for the reason that the design engineers had too short a time to do the job That they had the right idea w as proved by the performance of the Liberty after the War The Alli son engine will also be mass pro duced but under more favorable conditions There has been suf ficient development time and or ders for the engine have made it



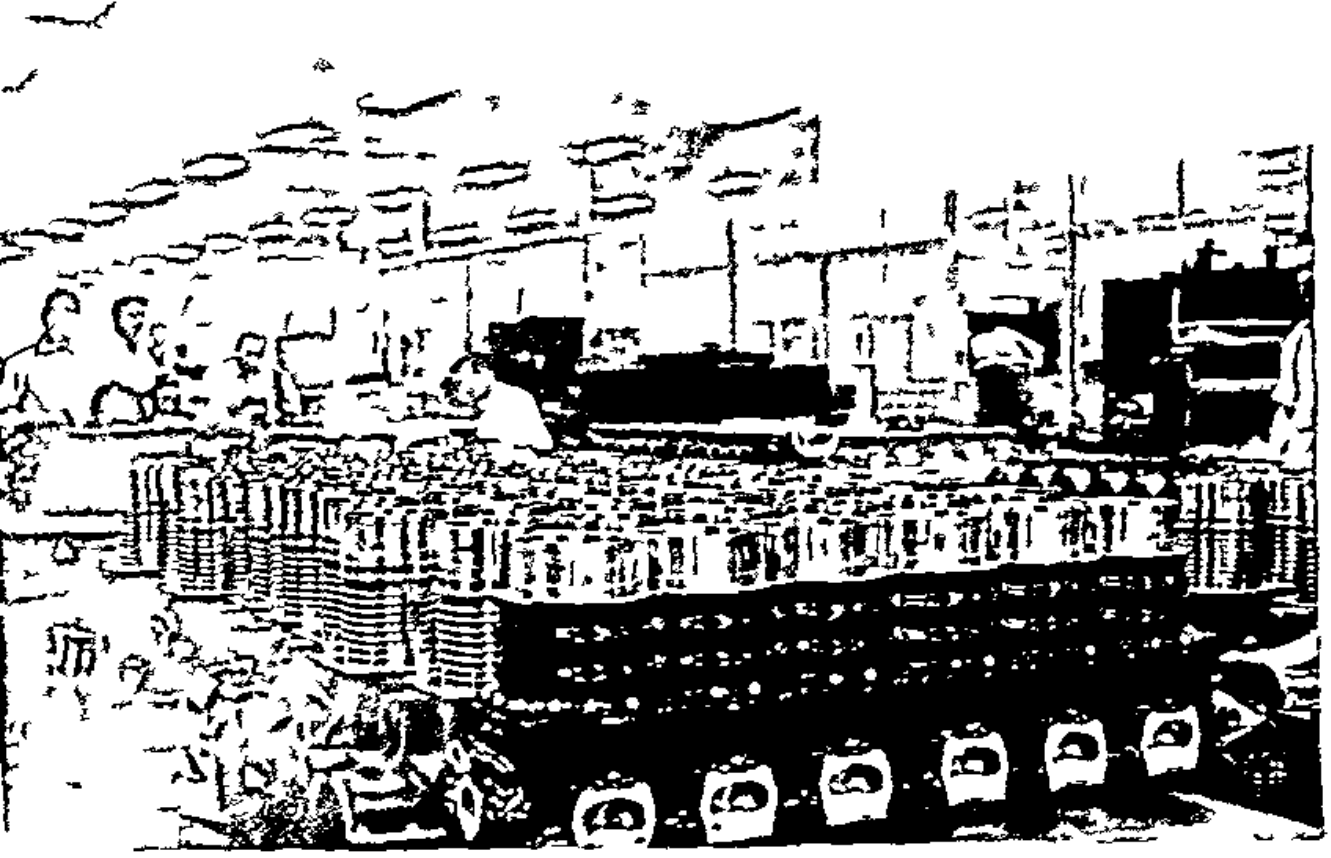
In the Ai acobra the eng ne s beh nd the p lot s cock p t allow ng better balance and v s b l ty for f ght ng



The A racuda carr es its two All son moto s in the rear of the gunners compartments g v ng the guns full play



The penc l shape of the A my s Curt ss P-40 pursu t sh p s made poss ble by the use of the l qu d cooled eng ne



Assembling cylinder blocks in the plant of the Allison Division of General Motors at Indianapolis Ind

possible for General Motors to tool up In deed, the preparation has been so thorough that General Motors can actually build bet ter engines by mass production tools tech nique than can ever be built by hand. The finest handcraftsman cannot duplicate the accuracy of American machine tools The problem is not so much in the application of the methods of mass production as it is in the adjustment of tools to operations upon materials that hitherto have not been sub- ject to such machining This is a matter of observation adjustment, and practice in op eration. Actually there are many tolerances in General Motors gasoline automotive en gines, and especially in its Diesel engines, that are as fine as those in the Allison. There are however more parts of the Al lison engine that require micrometric atten tion to limits than there are in the other General Motors engines.

THE Liberty which was also a V type liquid-cooled engine was rebuilt after the War in the very shops near the Indian apolis Speedway where Norman Gilman, an ingenious Yankee mechanic who had worked with Jim Allison on the old Lib- erties planned the first Allison. Convinced that the engine of the future would be liquid cooled, he discarded water as a cooling agent and designed an engine especially for the use of a chemical cooler This was in 1931 two years after the Allison plant had been bought by General Motors On April 23 1937 the first Allison motor passed the 150 hour test and the long struggle to get it into mass production began.

The engineers who are bringing it into production give three major reasons for their belief that it may prove superior to the air-cooled radial types to which most of our productive capacity has been devoted. Their reasons are first, the air resistance or drag is less than in the radial second the Allison can be divorced from the usual position directly behind the propeller third, it can maintain top speed for a longer time than the air-cooled motor

The claim of less drag is based chiefly on the difference in frontal areas the twelve cylinder Allison has a frontal area of six and a quarter square feet as against an area of over sixteen square feet in the radial en gine of the same horsepower The lower area is a result of the V shaped design in which the cylinders are in line arranged along a crankshaft, instead of protruding in the sunburst arrangement of the air-cooled radial. Drag increases as the square of the speed if the speed is doubled the air re sistance becomes four times as great.

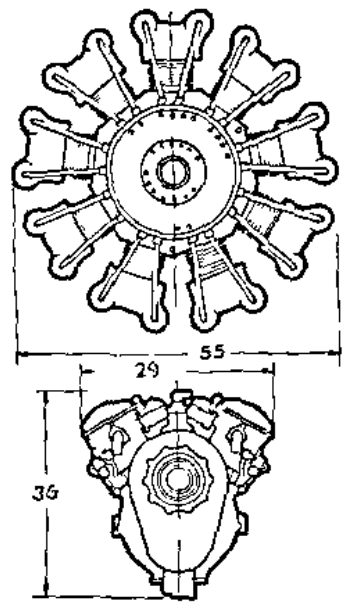
Distinctly more important is the fact that the Allison engine being cooled by the flow of liquid around its cylinders instead of by a flow of air need not be directly exposed to the air It can be completely hidden in the wings or go back toward the tail. This

freedom of the engine position gives the designer a greater opportunity to design for maneuverability which modern war technology and tactics may prove to be more important in combat than a few more miles an hour The Airacobra is a case in point Here the weights of the engine the pilot and the fuel are clustered around the ship s center of gravity Here again fast handling of the ship is helped by the better combat and searching vis on afforded by the pilot s position over the leading edge of the wing Moreover this plane requires a fuselage only thirty four inches wide—less than six times the width of this page—to take the compact Allison

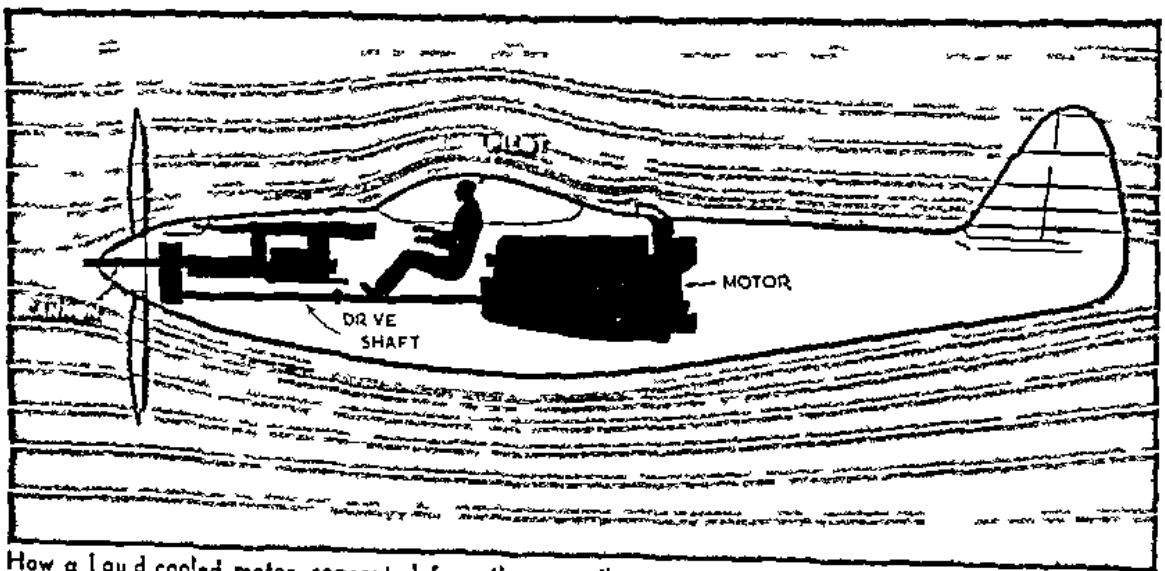
The Allison engine can maintain top speed longer because it is easier to cool Instead of water which was used in the Liberty engine the cooler is ethylene glycol the same chemical used in nonevaporating automobile antifreeze solutions Ethylene glycol is a by product of the synthetic production of glycerin Its boiling point is 387 degrees compared with the 212 degrees of water The pump forces it through the engine so swiftly that the heat dissipation is uniform in all cylinders

That s the Allison side of it There are engineers especially among the makers of air cooled engines who are not certain that Allison is all that its backers claim Most of them accept the streamlining advantages but they find them offset by the problems of installation But this is a technical debating ground where time and research will settle the question

The name Allison is a remembrancer of Jim Allison who with Carl Fisher founded the Prest O Lite Co and later established the Indianapolis Speedway so that they could play with racing cars Allison put up a machine shop to design and service the cars and gathered a staff of engineers and mechanics whose superintendent when the *U S entered the World War was Norman* Gilman an old fashioned Yankee mechanic When the war ended and surplus Liberty engines were being overhauled Allison obtained a contract to do some of the work It was then that Gilman invented the famous Allison bearing—bronze integrated with steel—which solved the problem of getting more horsepower out of the Liberties When Allison died and General Motors bought the plant (1929) to secure for development the bearings and a Diesel engine then being designed Gilman was made president and general manager of the new division He built gears and propeller drives for the Navy dirigibles and many special engines and began his study of the liquid cooled type through work on the German engines on the *Los Angeles* our trophy of the World War The air cooled engine had attained about 400 horsepower but Gilman like one or two other engineers became firmly convinced that the liquid cooled type of power plant was destined to be the airplane engine of the future



COMPARISON OF FRONTAL AREAS OF RADIAL AND IN LINE MOTORS



How a liquid cooled motor separated from the propeller permits streamline design for higher speeds



Sound Guides Rocket Bomb Against Enemy Aircraft

GUIDED entirely by sound a rocket bomb developed by J R Fish a West Springfield Mass inventor is designed to zoom straight for an enemy airplane at the almost incredible speed of 900 miles an hour According to the inventor the rocket incorporates magnetic controls actuated by acoustic apparatus steering itself directly toward the sound of an airplane motor to explode with terrific force when it reaches its objective Ordnance engineers of the U S Army are said to be interested in the rocket projectile and to have arranged a secret test of it on an uninhabited island off the New England coast



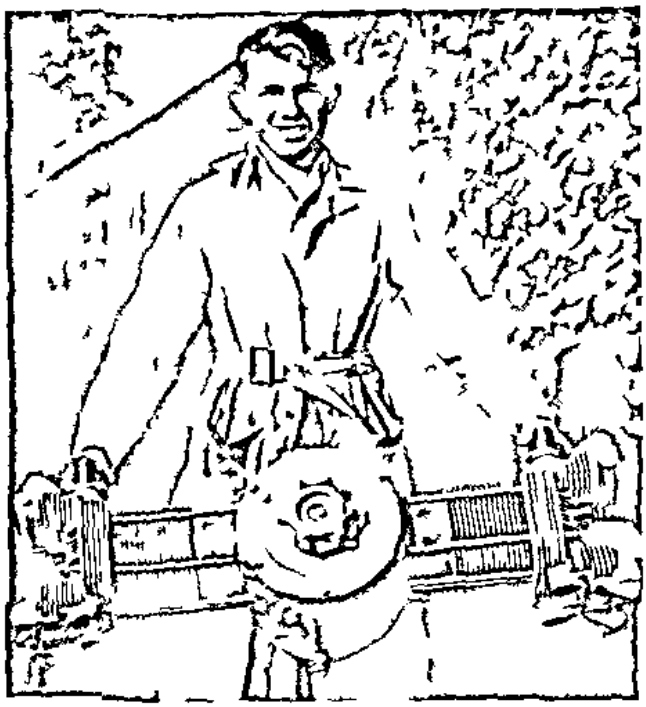
How the balloon is used to equalize air pressure

Balloon Ends Discomfort in High-Altitude Flying

TO MAKE things more comfortable for passengers and pilots flying at high altitudes Dr Ralph Greene Miami Fla physician and medical consultant to Eastern Airlines developed the balloon device pictured at the left. Costing only a few cents the small balloon has a nipple fitted to its neck When high altitude pressure becomes annoying the passenger inserts the nipple in one nostril closes the other with his finger and inflates the balloon He then squeezes the balloon slightly and swallows In this manner the pressure of the air within the inner ear is equalized with the outside pressure

Engine for Light Planes Weighs 130 Pounds

AN AIRPLANE motor that weighs considerably less than the two passengers who ride in the plane it powers—that is the accomplishment of Julius Dusevoir inventor of San Leandro Calif Actually tipping the scales at only 130 pounds the light weight motor is rated at seventy five horsepower and will power a two place light plane with ease The engine air cooled and of double opposed type utilizes a built up roller bearing crank shaft a development perfected some time ago by the same inventor One other outstanding feature of the light weight motor is the fact that it can be dismounted and dismantled with nothing more than two wrenches as tools The lightness of the motor gives the plane in which it is installed increased pay load or larger fuel capacity



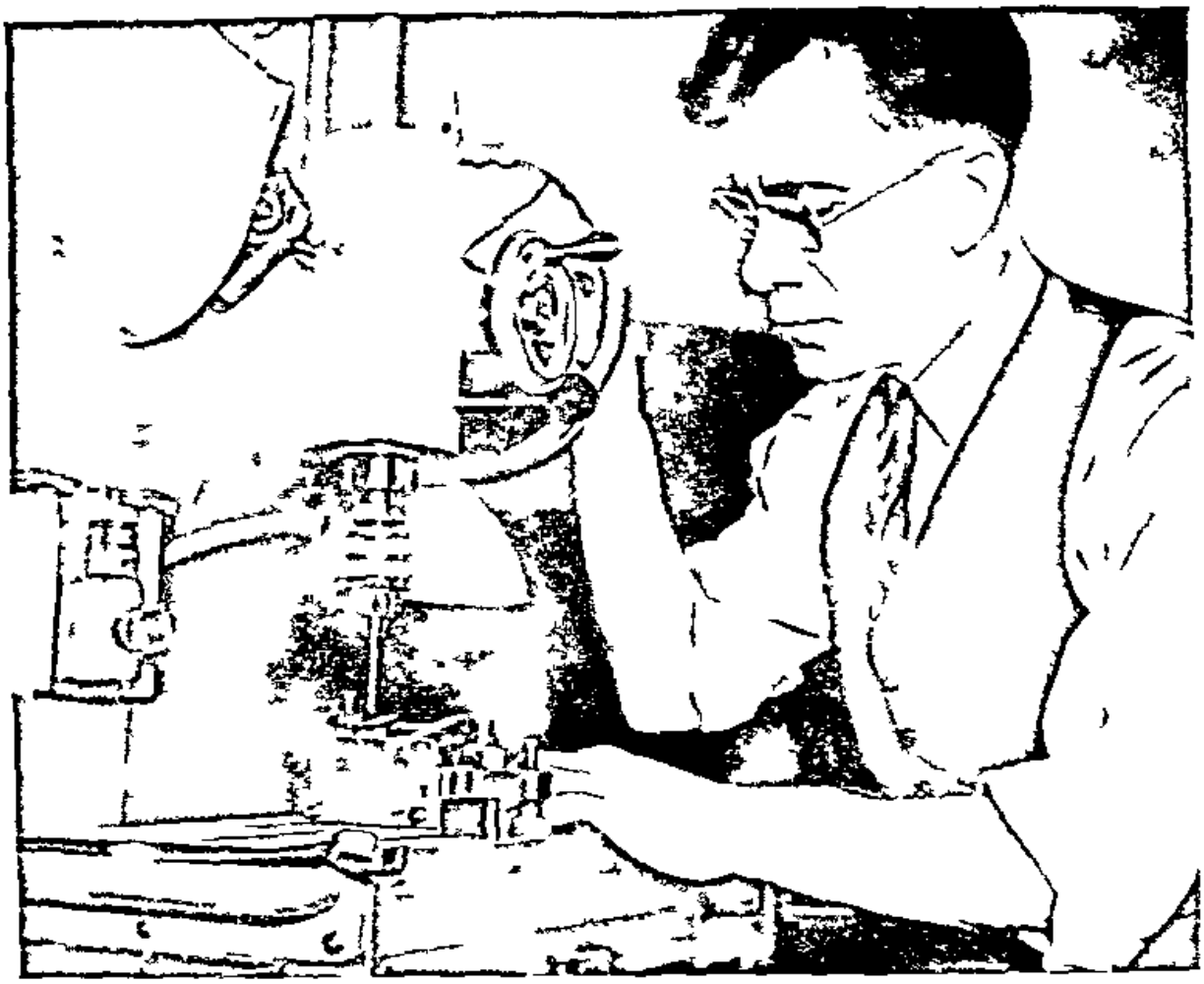
A man can easily lift this seventy five horsepower motor

Signal Lamps Direct War Pilots in Patrol Formations

PICTURED in a recent action patrol along the Danish coast the British airman shown below in an American built Lockheed Hudson plane is making use of a special signaling lamp to give instructions through the plane windows to other craft in the patrol formation By this means the leader of a squadron or group can signal units under his command without using his radio and thereby revealing his position



A method through the window of a plane the signal lamp blinks the leader s orders to accompanying craft



John C. Garand c eato of the U S Army s powerful new sem automat c fle ope at ng a d l p ess

HE INVENTED THE WORLD'S Deadliest Rifle

By EDWIN TEALE

THE Un ted States Government is lay ing a $15 000 000 bet that the new Gar and semiautomatic rifle is the deadliest firearm ever invented. At the great, sprawling Springfield, Mass., Armory orig inally established by George Washington, Garand guns by the thousands are whizzing off the production lines while outs de swarms of workmen rush through the con struction of a vast addition to the plant.

Reams of publ c ty have carried the news of this rifle to practically every wide awake U S c tizen. But what about the man be-hind this particular gun? Who is this Gar and, and what is he l ke? How d d he hap pen to invent the weapon that will make every American doughboy a one man ma chine gun nest?

Alert, athletic square jawed—that was my first impress on of John C. Garand when I walked into his Springfield Armory office a few weeks ago. As you talk to h m, you not ce that he pronounces certain words with a soft French Canadian accent—a relic of his earl est years on the farm where he was born twenty miles from Montreal. He was seventh in a family of fourteen chil

dren His mother died before he was eight years old and the family moved south to Jewett City Conn Here at twelve an age when most children are still in grade school young Garand started work as a floor sweeper and bobbin boy in a New England textile mill

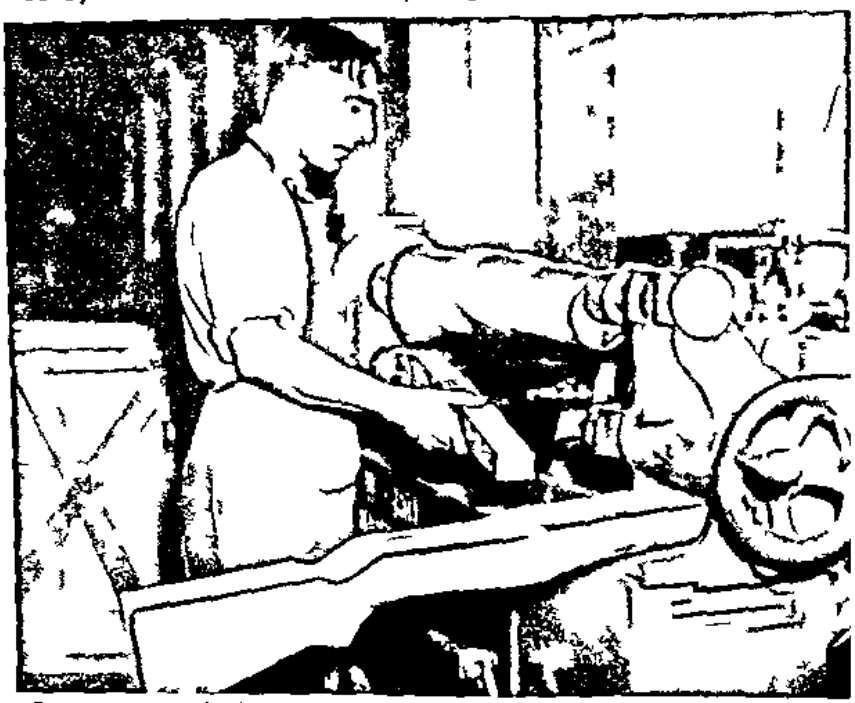
Machinery had always attracted him Even today Garand s idea of an exciting night s reading is to settle down in an armchair with a pile of machine shop magazines beside him During the short rest periods while the bobbins were filling up the boy used to haunt the end of the plant where the textile mechanisms were repaired The foreman noticed him took a liking to him and let him pick up extra pennies scouring down rough places on spindles with a piece of building brick A year after he came to the mill Garand was a boy inventor with a patent of his own He had designed a new type of jack screw

As soon as he began making money Garand started saving toward a rifle With one of his brothers he used to spend evening after evening poring over the gun pages of a mail order catalogue debating the merits of the different firearms Finally the boys pooled their resources and sent off a money order for a Winchester 32 20 When it arrived with a blue shiny barrel and smelling of fine oil they discovered it had such a range that they couldn t shoot it without endangering cattle and farmers for miles around

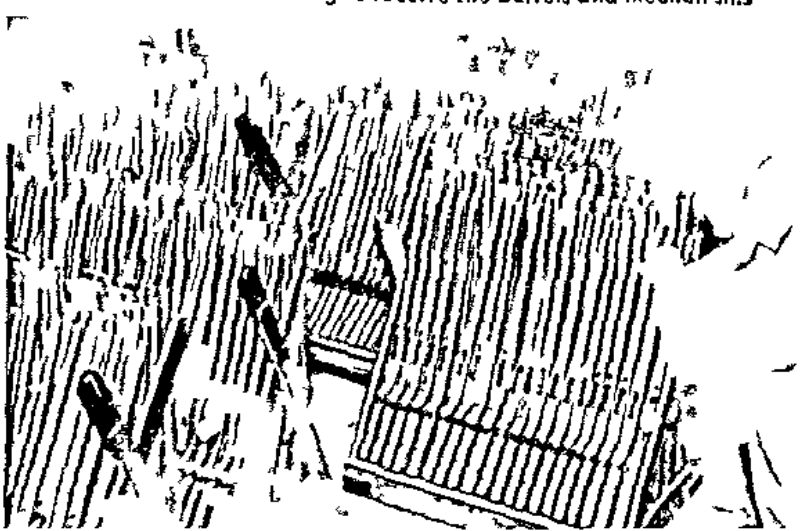
It was Garand s fertile brain that solved the difficulty Obtaining a bent heavy metal pipe the boys lugged it to a little hillock in the middle of a field There they propped it up so that one end formed a bull s eye and the other pointed skyward At 200 yards the boys drove their bullets into the open mouth of the pipe The right

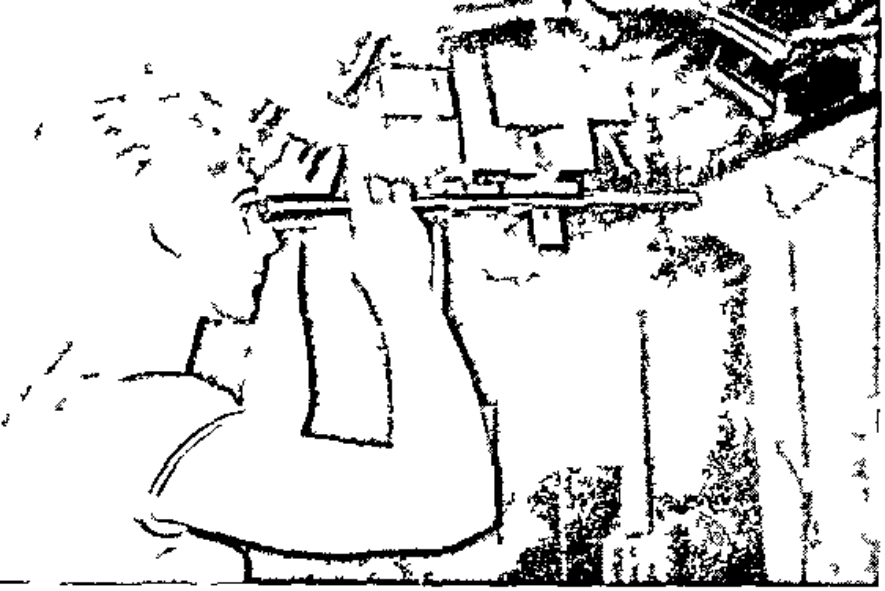


This is the barrel rifling section of the Springfield Mass Armory where Garand rifles are made for our doughboys Big lathes tended by skilled craftsmen cut the spiral grooves inside the barrels

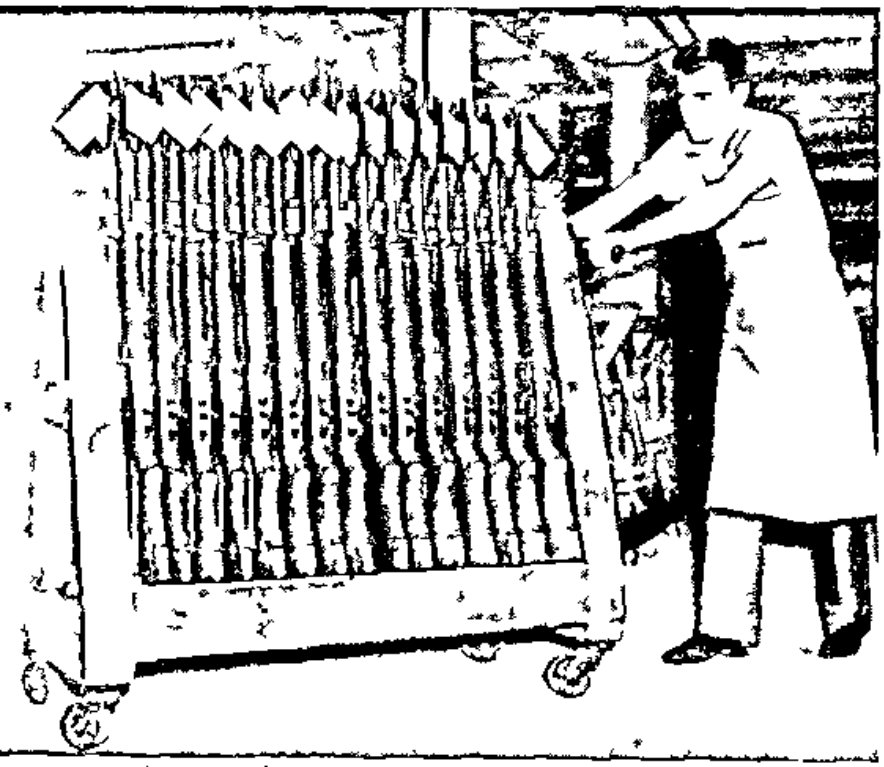


The flat sided blank of Canadian black walnut in the hands of the workman above will become a glossy brown rifle stock Two rounded pieces are seen in the machine In the photograph below racks of finished stocks are waiting to receive the barrels and mechanisms





Stra ghten ng a ba rel Under a tra ned eye the mach ne appl es pressure to correct sl ght mperfect ons Spr ngf eld s turn ng out 500 Garands a day and expects soon to ra se t to 1 000 a day



Guns for th rty more sold ers a batch of completed r fles in spected tested and tagged moves off to play ts part in Uncle Sam s b g defense program Below Garand looks on as Col G H Stewart command ng off cer at the Armory exam nes the p oduct



angle curve sent the lead streaking toward the stratosphere However its ear splitting zing' resounded over the countryside and farmers who were convinced a bullet had just missed their ears came dashing up in bug gies to register emphatic complaints It usually took a long argument and a couple of demonstrations before they were satisfied

By the time he was eighteen Garand was a full fledged machinist at the textile mill As a side line one summer he and his brother ran a shooting gallery at Norwich Conn That was a lot like a boy with a sweet tooth managing a candy store Their enthusiasm for target practice ate up most of the profits

Not long afterwards young Garand landed a job in a Rhode Island tool factory and moved to Providence There the speed bug bit him and he took up motor cycle racing An engine of his own design carried him to victory at various New England tracks Less dangerous but still giving the thrill of speed and balance was his next interest —fancy skating on ice That occupied his leisure for several winters He would still

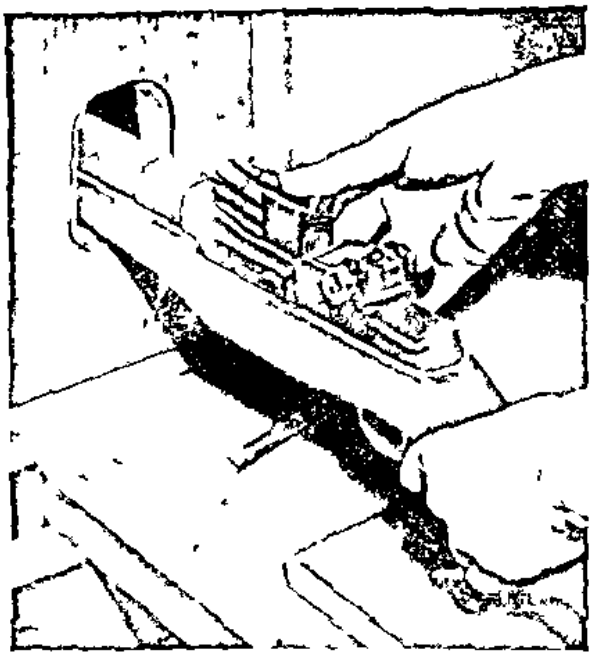


like to whirl and spin on skates, but he doesn't have time to practice In spite of such varied hobbies, he always kept coming back to firearms They formed the center of his interest.

In the early days of the World War, Garand came to New York, working in a micrometer plant in lower Manhattan Saturdays invariably found him alighting from the subway at Coney Island with a target shooter s light in his eye He was star patron of all the galleries along the boardwalk Wages were good, and he shot to his heart's content When he moved from one gallery to another, a queue of onlookers trailed behind One Saturday, when he was finding out about rifles by using Coney Island as a laboratory, he shot at every target there By nightfall, he had set an all time high for himself, not only in score but in expense as well. He had spent $100 at the galleries in a single day!

Luckily for his bank balance, he discovered a gallery near Times Square, about this time, where the proprietor would let him shoot free Firing a rifle from the hip so accurately that he could hit a swinging target seven times on a single swing, he always attracted a crowd that overflowed onto the sidewalk and kept the cash register ringing at the gun counter

During this period, when Garand was running the World War a close second in booming the stock of ammunition makers, he was taking correspondence courses, studying nights to complete a formal education that had stopped when he was twelve One evening, before he sat down to his lessons, he read in a newspaper that the Government was having difficulty finding a satisfactory

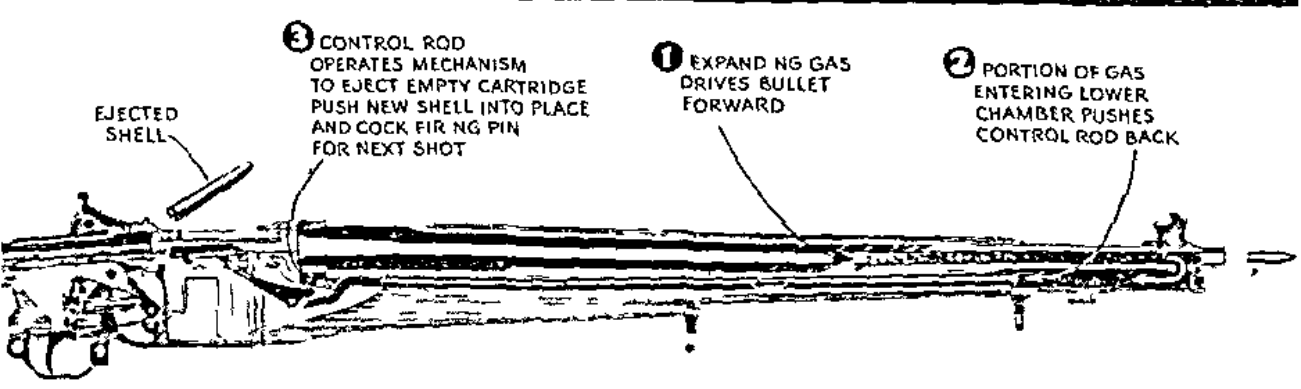


Before a new rifle leaves the Springfield Armory it must pass this firing test in the proving room

machine gun He couldn't see why there should be any problem about that, so he sat down and designed a machine gun of his own Folding up his drawings, he slipped them in an envelope and addressed it to the Naval Board, in Washington, D C.

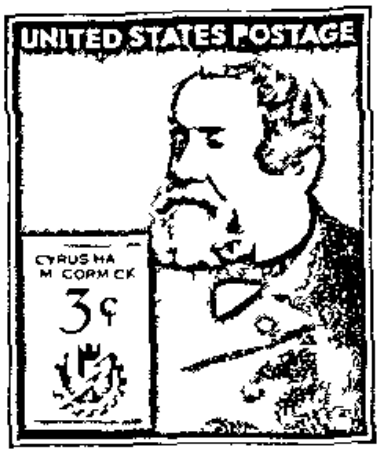
That act switched Garand onto the main track of his life work. It gave point and direction to his consuming interest in guns.

In due time, a letter came back from the Naval Board The experts were sufficiently interested in his drawings to invite him to come to Washington for a conference The upshot of that *(Continued on page 295)*

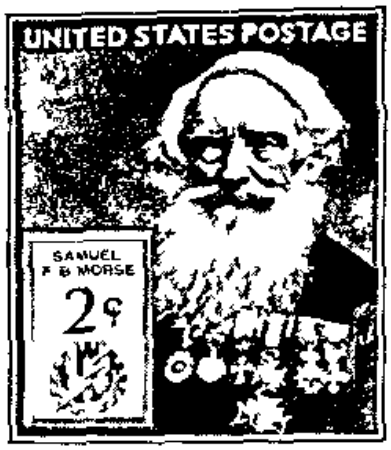


THIS drawing shows how the Garand semiautomatic rifle harnesses the ' kick to load the gun for the next shot The pressure of expanding gas which drives the bullet from the barrel also operates the mechan sm that ejects the empty shell and throws another cartridge into firing position All the soldier has to do is to keep pulling the *trigger*

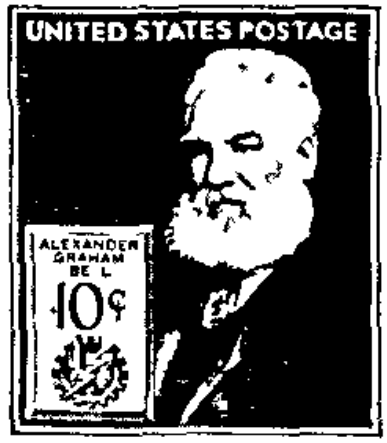
New U.S. Stamps Honor Great American Inventors



CYRUS H McCORMICK whose invention of the reaping machine helped pave the way for America's great agricultural development was born in Walnut Grove Va in 1809 His first reaping machine was built in 1831 and patented in 1834 In 1847 McCormick went to Chicago and founded what is now the International Harvester Company He died in 1884



SAMUEL F B MORSE was a successful portrait painter before he invented the telegraph Born in Charlestown Mass in 1791 he studied art after his graduation from Yale The idea of the telegraph occurred to Morse on a voyage from Europe and the invention was exhibited in New York in 1835 In 1844 the first public message was sent. Morse died in 1872



ALEXANDER GRAHAM BELL father of the telephone was born in Edinburgh Scotland in 1847 He came to Canada in 1870 and two years later became professor of vocal physiology at Boston University His telephone was demonstrated at the Philadelphia Exhibition in 1876 Bell was greatly interested in the welfare of the deaf and later in aviation He died in 1922



ELI WHITNEY revolutionized the South's cotton industry with the invention of the cotton gin Born in Westboro Mass in 1765 he was studying law in Georgia when he was asked to develop a quicker way to separate the cotton fiber from the seeds Using tools of his own making he produced the ginning machine which was patented in 1794 Whitney died in 1825

FIVE great American inventors are honored in commemorative stamps just issued by the U S Post Office Department in the Famous Americans Series Each stamp bears an unframed portrait of the inventor whose name appears on a panel in the lower left corner with the denomination and a device representing a cogwheel, uplifted wings, and a lightning flash — symbolizing power, flight and electricity Edison is not included, as a special stamp in his honor was issued recently



ELIAS HOWE gave us the sewing machine Howe was born in Spencer Mass in 1819 Although his lockstitch sewing machine was patented in 1846 he had difficulty in getting his invention accepted and then in fighting infringements on his patent rights After a long series of court battles he won out and made a large fortune Howe died in 1867



MOBILIZING MATERIALS

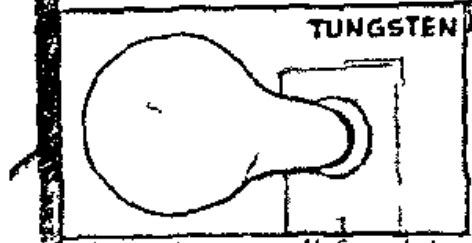
By ARTHUR GRAHAME

A TELEPHONE bell rang in the office of Edward R. Stettinius Jr., chief of the National Defense Advisory Commission's materials division. It was the Chinese Embassy calling. A sizable quantity of tungsten had just become available in Indo-China. Would the United States be interested?

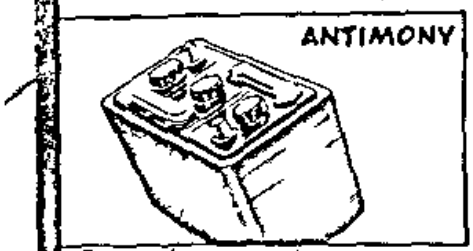
It most certainly would. Three calls by Stettinius brought quick results. The Reconstruction Finance Corporation would supply funds for the purchase. The Procurement Division of the Treasury would instruct one of its agents to do the buying. The



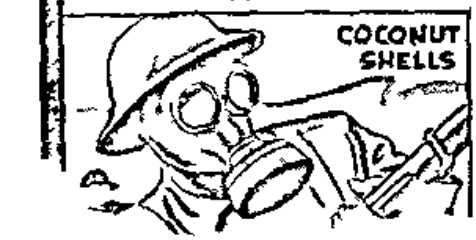
U S synthet c f bers such as Nylon could take place of s lk



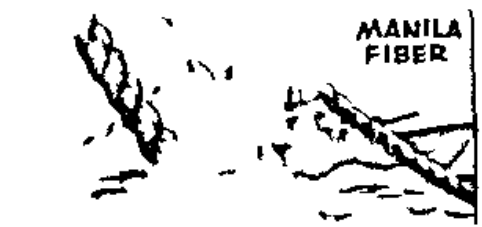
A te nate source U S subst tute fluorescent tube l ght ng



By develop ng ou home sources we could supply all our needs



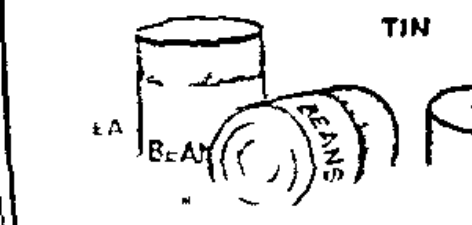
A te nate sou ces Flo da West Ind es Subst tute t eated wood



Cent al Ame can hemp U S cot ton synthet c f bers replace it



New sources U S Canada Sou h Amer ca Subst tute clay "paper"



A e na p sou ce Bo v a Sub t tutes other food packag ng

U S synthet c f bers such as Nylon could take place of s lk

A te nate source U S subst tute fluorescent tube l ght ng

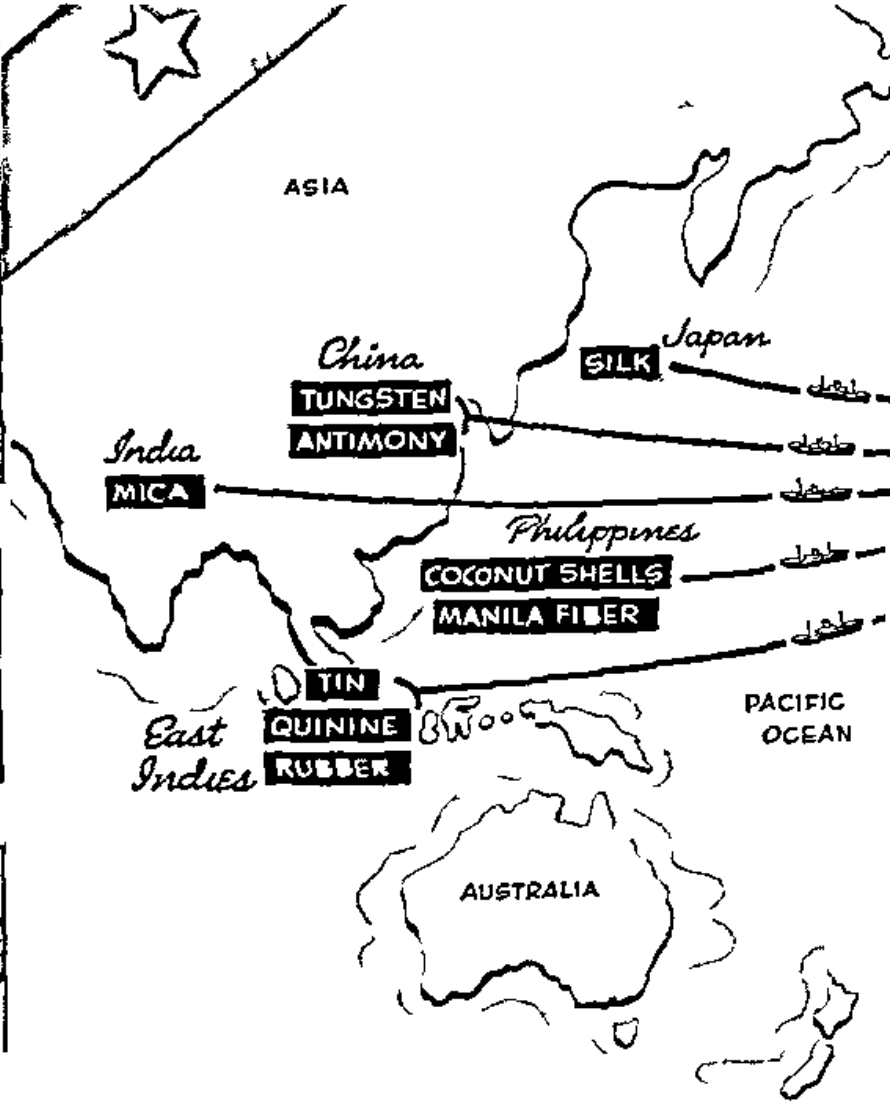
By develop ng ou home sources we could supply all our needs

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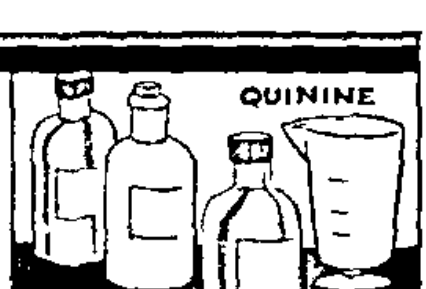
scarlet ore this year may amount to 25 000 flasks In time of peace this is enough to fill all our needs But what of extra wartime demands?

Here is where the second phase of our raw material preparedness comes in—to find substitutes that can replace or supplement items on the strategic list If Germany and other embattled countries can go *ersatz* so can we and our chemists and metallurgists are prepared to go them one better Surprises are in store for housewives and soldiers alike

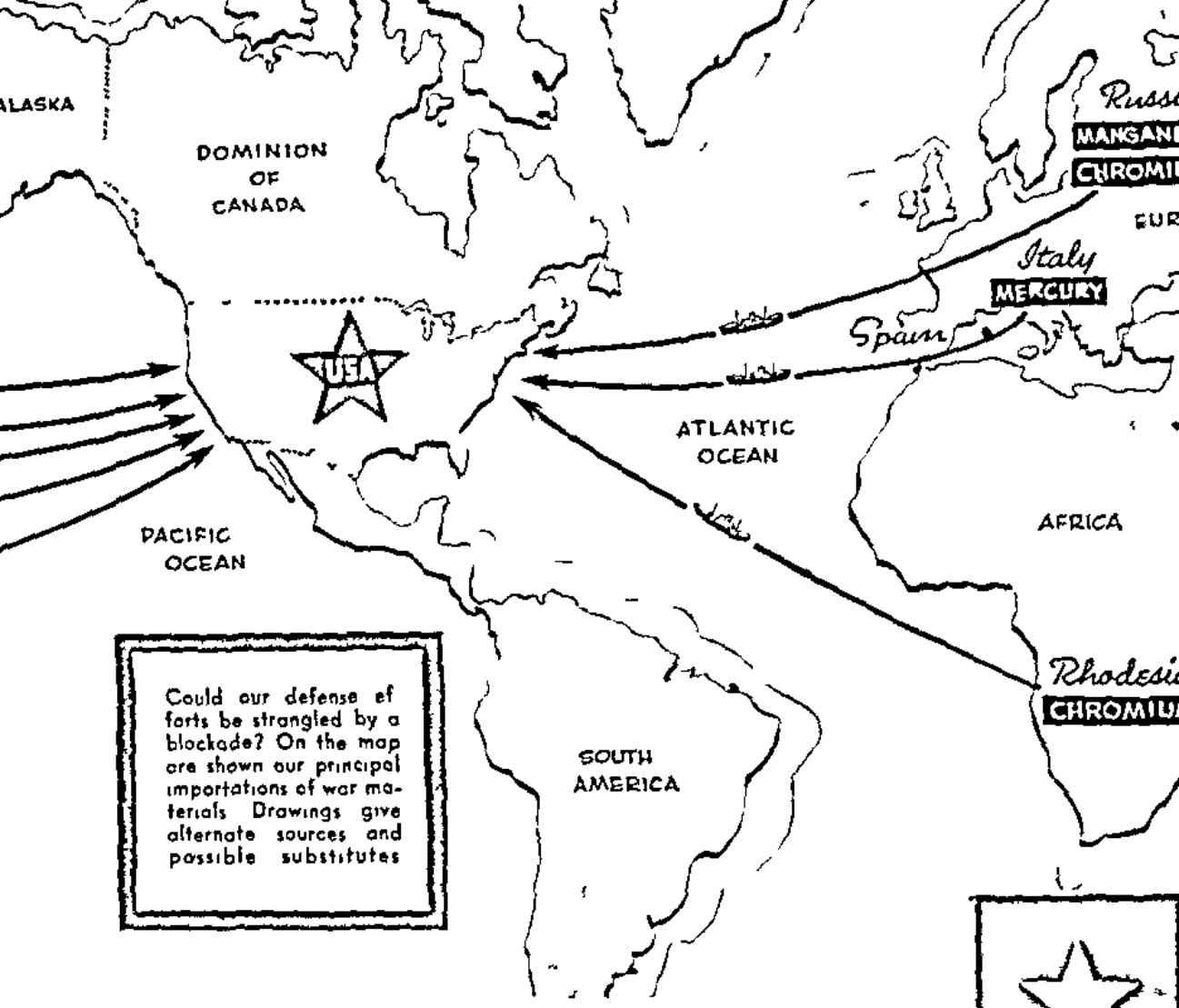
Eating soup and beans out of silver lined cans appears a likely prospect. To make ordinary tin cans a coating of tin is applied to black plate or flat rolled steel In case of need however the steel could be plated first with copper and then with silver Since the *precious metal coating need be no more than a mil* lionth of an inch thick it would cost only $1 60 to line 1 000 quart size cans with s lver according to Dr



Ame can manufactu e s con make synthet c rubber f om pet oleum



Synthet c p epa at ons can re place qu n ne for med cal use



Alexander Goetz of the California Institute of Technology An alternate proposal suggests substituting bags of Pliofilm, a new synthetic material, for cans

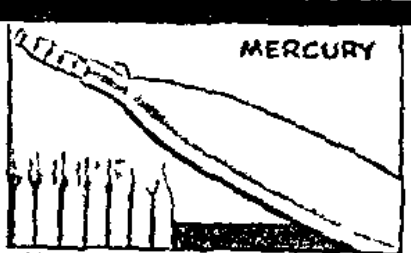
Parachutes made of Nylon, the Du Pont fiber made from coal, air, and water, have been tried out experimentally by the U S Army Air Corps and found to function perfectly They may help to solve the problem of our dependence upon Japan for silk, of which standard chutes are fashioned

Fulminate of mercury, highly sensitive to the slightest shock, has a new rival for use in the detonators of shells and bombs The substitute a chemical called lead azide, keeps better and contains no mercury, so the liquid metal may soon be crossed off the roster of strategic materials Other substitutes have been found for mercuric chemicals in less widely known uses—making blue printing ink, dental rubber, and barnacle-repelling paint for ships' bottoms

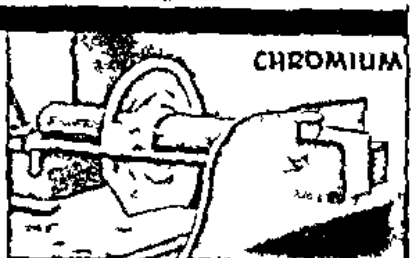
Automobile tires of synthetic rubber, long talked about, now are being marketed in the United States Instead of making it from coal as Germany does, American chemists start with petroleum Thus, mill



An electrolytic refining process makes American ores available



New sources: U S, Mexico Non mercurial detonating chemicals



New sources of chromium can be developed in U S, Cuba, Alaska

itary vehicles may soon be rolling into battle on tires made from the same raw material that provides fuel for their carburetors An $80 000 000 program for expand ng experimental synthetic rubber factories into big mass production plants has already been initiated the National Defense Advisory Commission reports

But it takes precious months to develop mines and to get new factories into production In a nat onal emergency could we do it in time? To tide us over that critical period while war industries are getting into high gear the third and most immediately important part of our strategic material program is being put into effect

Gigantic piles of imported war metals and other supplies are being laid in by Government agencies and stored on military reservations for fire use only Kept intact unless war comes they would then be thrown into the balance while new sources were catching up with military demands

Beginning last year the United States has been stocking up heavily on thirty seven strategic and near strategic materials Its fast growing reserve of manganese intended to fill all war time needs for a year results from orders placed in India Africa Chile and at home The Anaconda Copper Company has contracted to furnish 80 000 tons a year for three years from its Emma mine in Montana A rising pile of chromium results from orders placed first in Turkey and Alaska Wherever possible contracts have been awarded to foster development of United States and Western Hemisphere sources at the same time urgent needs must often be filled from far away countries Huge international cartels have contracted to furnish us nearly a

Glow ng molten metal gushes from an open hearth furnace to f ll ingot molds as Amer ca s steel ndustry works n ght and day on defense orders

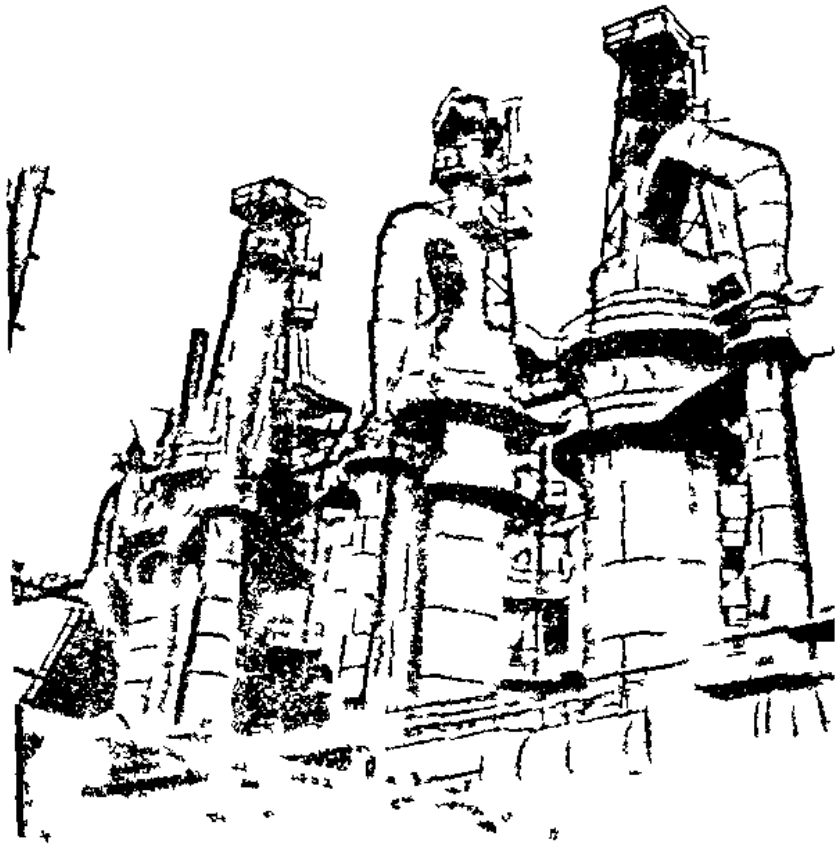


year s supply of vitally important rubber and tin

Odd items appear in some of the orders—for instance tons of quinine to ward off disease if our soldiers operate in the tropics Quartz crystals will be needed to keep radio transmitters on the right frequency in an emergency they could be flown by plane from Brazil but the United States is forehandedly laying in plenty for storage

Novel commercial arrangements have been concluded and are under negotiation We wanted 85 000 tons of British rubber The English wanted 600 000 bales of American cotton It was a deal Despite war difficulties a large proportion of the rubber has been delivered At this writing the United States and Great Britain are working out a plan to store 200 000 000 to 300 000 000 pounds of British wool in this country subject to purchase for the U S Army in case of war Then it would be made into Army overcoats and blankets

So far the story has been of America s weaknesses and their cure With these headaches off our mind we can settle back and comfortably reflect on our strong points No other country in the world can boast such an enviable assortment of natural resources at home



Blast furnaces like these at Gary Ind are going full blast Steel is the backbone of any armament program and we have the makings of steel iron and coal

Food most essential of all raw materials in war or peace isn t one of our defense worries We raise more than we eat of almost every important foodstuff from apricots to wheat We won t have to choose between cannons and butter—we can have all we want of both If war should come mild rationing of sugar and coffee might be necessary But our ability to import large quantities of both commodities from Latin American countries bordering on the Caribbean probably would avert even that inconvenience

Steel is the great essential of armament and iron and coal are the principal raw materials used in steel making We have enormous reserves of both and can easily mine enough to meet even the tremendous demands of all out warfare

War in the air the use of oil as fuel for modern fighting ships and mechanized warfare on land have combined to make petroleum an imperative military necessity Our resources greatest in the world will fill all needs for oil and leave an ample supply for making synthetic products Large stocks of the comparatively new 100 octane aviation gasoline are being accumulated and stored for Army and Navy air forces



Rolls of cloth for Army uniforms at the Quartermaster Corps Depot n Ph ladelph a Pa where cloth ng and other equ pment s manufac tu ed M ll ons of ya ds of text le mater als are be ng purchased

Besides these principal sinews of war we have or are sure of being able to obtain virtually all the rest—copper lead nitrates sulphur magnesium cotton lumber to mention only a few With newly acquired reserves of the ones we have lacked we are perfecting our armament on the economic front—where undeclared wars may be waged without firing a shot and where battles may be decided before they are fought

A tank car of petroleum may be worth a good many bombs and a few shiploads of iron ore may prove as valuable as a whole squadron of planes to a country less fortunately endowed with raw materials than our own Conversely the nation that has them in abundance is in a commanding position to bid for international advantages and to wage war or put a brake on it.

The United States embargoes shipments of aviation gasoline outside the Western Hemisphere—ostensibly to conserve our supply but incidentally denying it to militant Japan We lend China $25 000 000 to be repaid by future shipments of tungsten As Japan gobbles up French Indo China America cuts off vital Japanese supplies of scrap iron for warships and armament To make Brazil independent of Europe for heavy steel U S experts and a $20 000 000 loan will help build the largest steel plant in South America—freezing out Krupp the great German armament concern and other foreign interests

In tense dramatic moves upon the chessboard of international politics raw materials will continue to make big news Even in peace America s wealth in them plays a powerful strategic role And in war you can strike an enemy as effectively with a lump of manganese as with a bayonet.

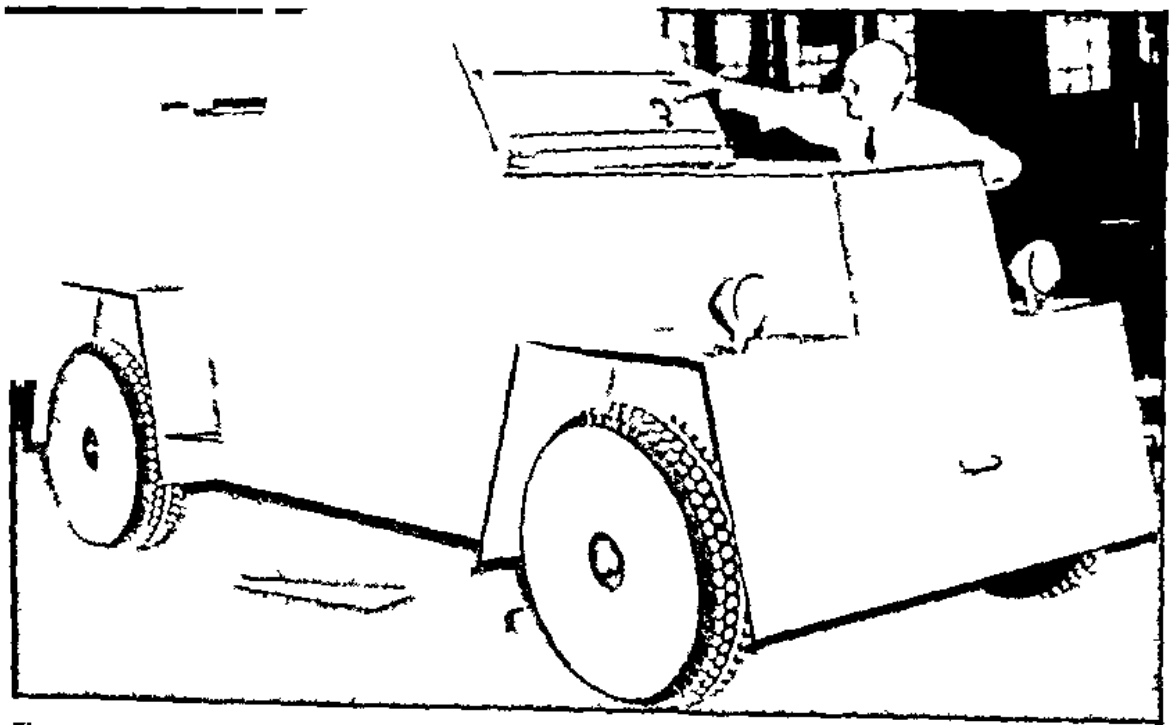


"Night Glasses" Train Soldiers To Fight in the Dark

FOR practice in fighting in the dark cadets in a British officers training unit wear special night glasses during daytime maneuvers Fitted with dark lenses the glasses reproduce the visibility conditions that would be encountered at night In this way the young soldiers learn to recognize the landscape as it appears in darkness and acquire skill in taking pot shots when they cannot see their rifle sights In the photograph above several cadets are using the glasses which turn day into night.

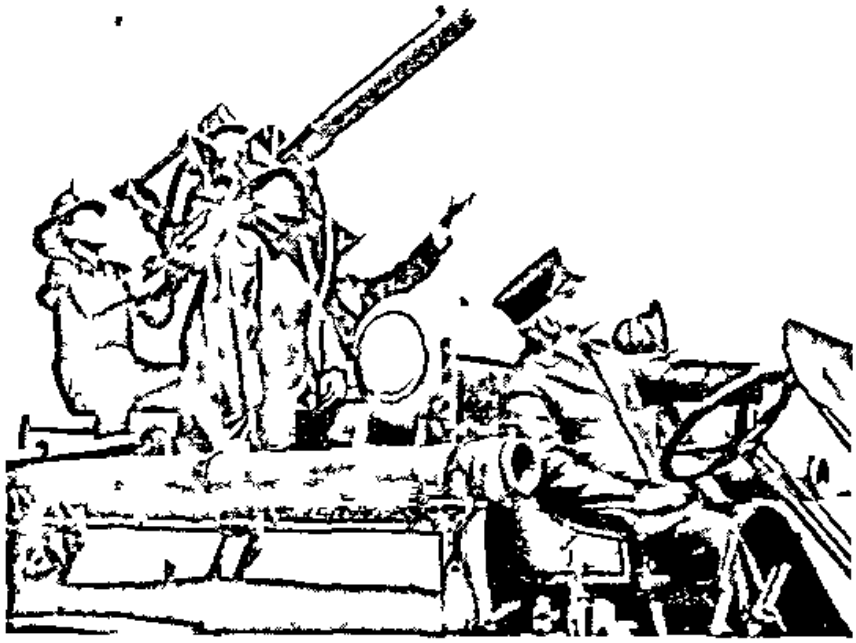
Bulletproof Body Turns Any Auto into an Armored Car

EVERY automobile in the United States is potentially an armored car under a plan recently proposed to aid the national defense program The scheme would provide tanklike bodies of half inch steel which could be speedily mounted on the chassis of standard cars Swarms of these minute man tanks the proponents claim would prove an invaluable aid in combating invaders and parachute troops



This minute man tank was made by mounting a body of half inch steel on a standard automobile chassis

Firemen Learn To Fight Air Raiders as Well as Fires

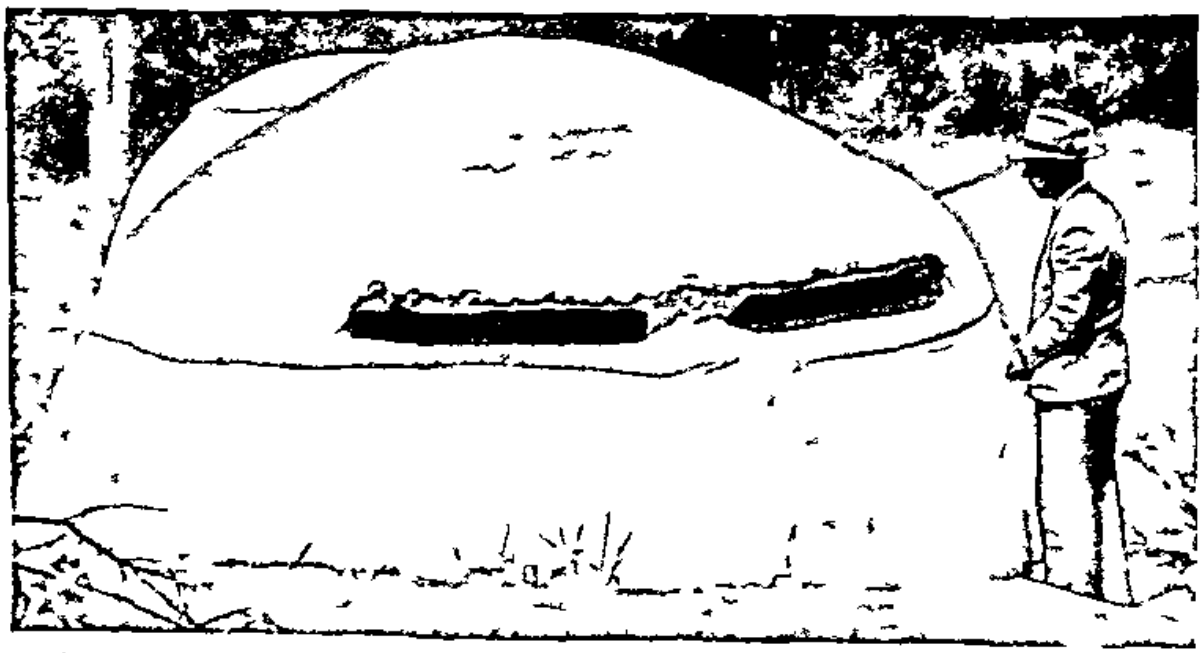


Boston smoke eaters training an antiaircraft machine gun instead of a hose

BY MOUNTING an antiaircraft gun on a fire engine smoke eaters of Boston Mass recently demonstrated how their force could cope with an enemy air raid Now plans are reported to arm a number of other fire trucks similarly and to train gunners with the cooperation of the National Guard. In case the firemen were attacked by low flying raiders while putting out a fire started by air bombs the powerful machine gun would provide an effective defense Other engines roaring along highways with sirens shrieking would serve as mobile antiaircraft units exclusively supplementing the work of regular military defense units

Concrete Pill Box or Bomb Shelter Is Built in a Day

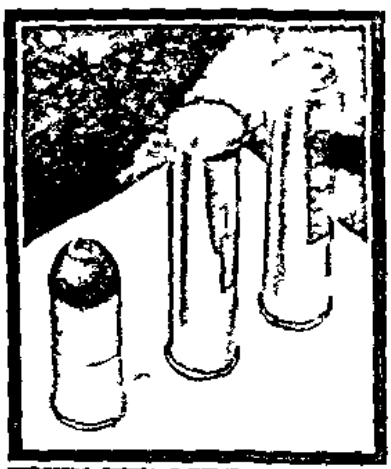
CONCRETE pill boxes may be erected in a single day by a speedy new method exhibited to War Department observers at New Haven Conn The structures may be used either as fortresses or as bombproof shelters during air raids A biscuit shaped design found most suitable for the purpose shown in the illustration below measures fourteen feet in diameter and has walls a foot and a half thick

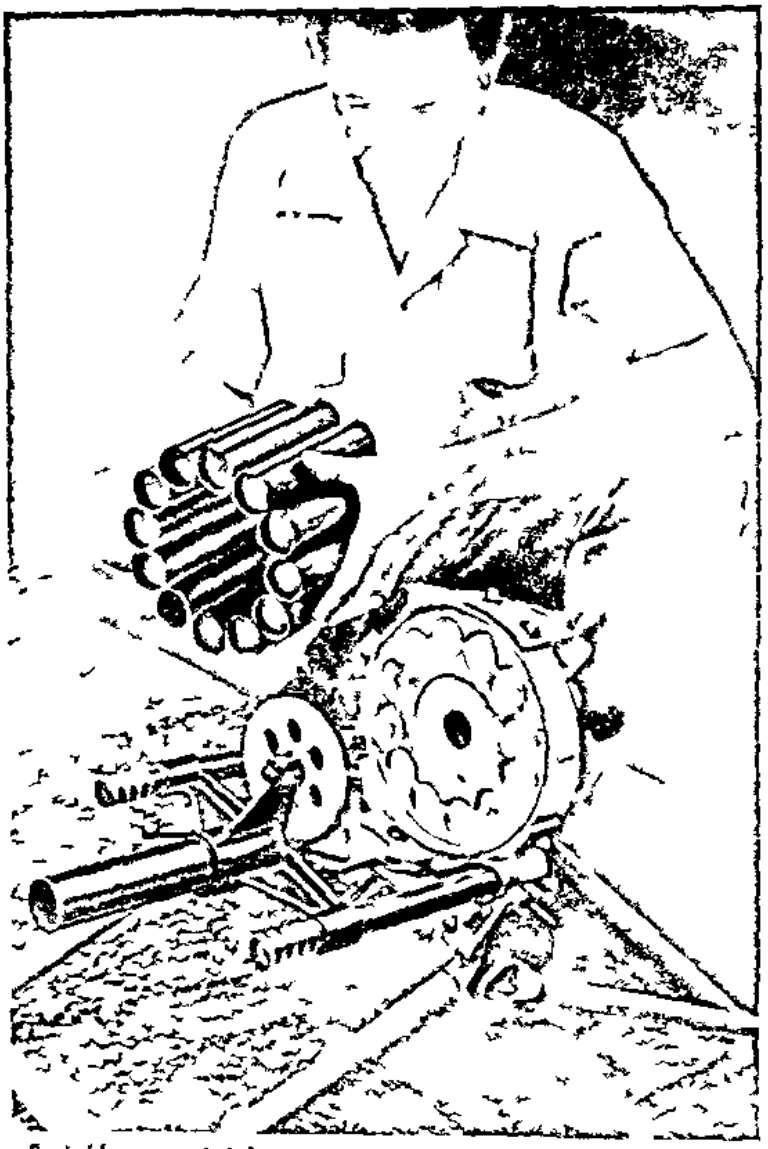


In an emergency structures like this can be erected quickly for use by either soldiers or civilians

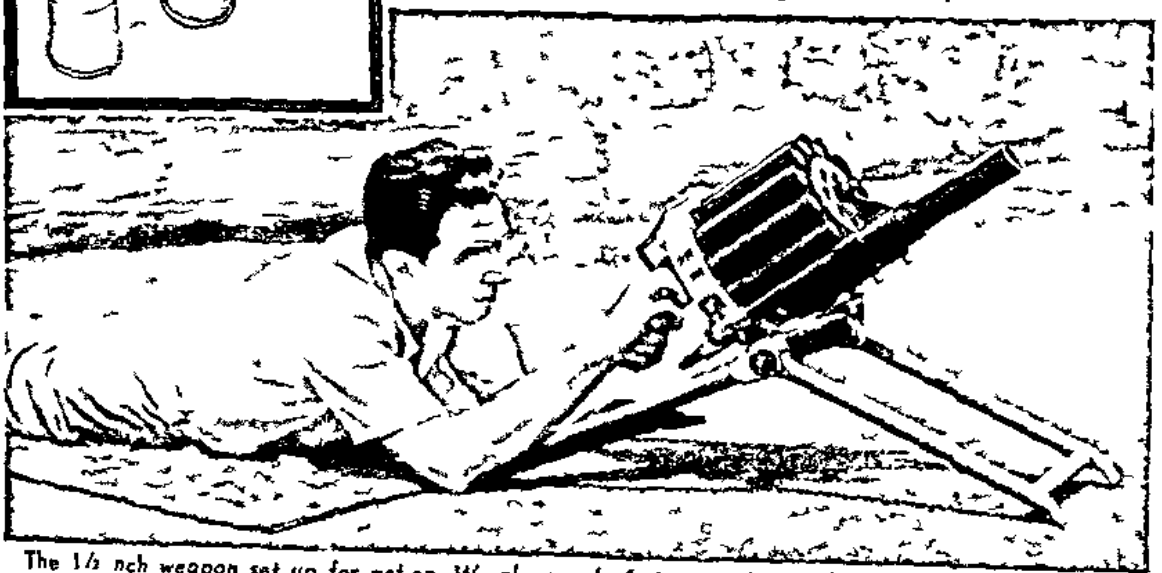
All-Purpose Gun Guards Airport from 'Chutists

SPECIALLY designed for defending military airports against attack by enemy parachutists a portable all purpose gun tested recently at Floyd Bennett Field New York City fires tear gas and smoke shells parachute flares and one pound fragmentation bombs Projectiles are placed in a twelve shot magazine resembling a revolver cylinder which can be changed in three seconds for reloading Weighing only forty pounds the versatile weapon has a barrel of 1½ inch bore and can be folded up quickly for carrying It is believed that a few of these guns could ward off any parachute attack

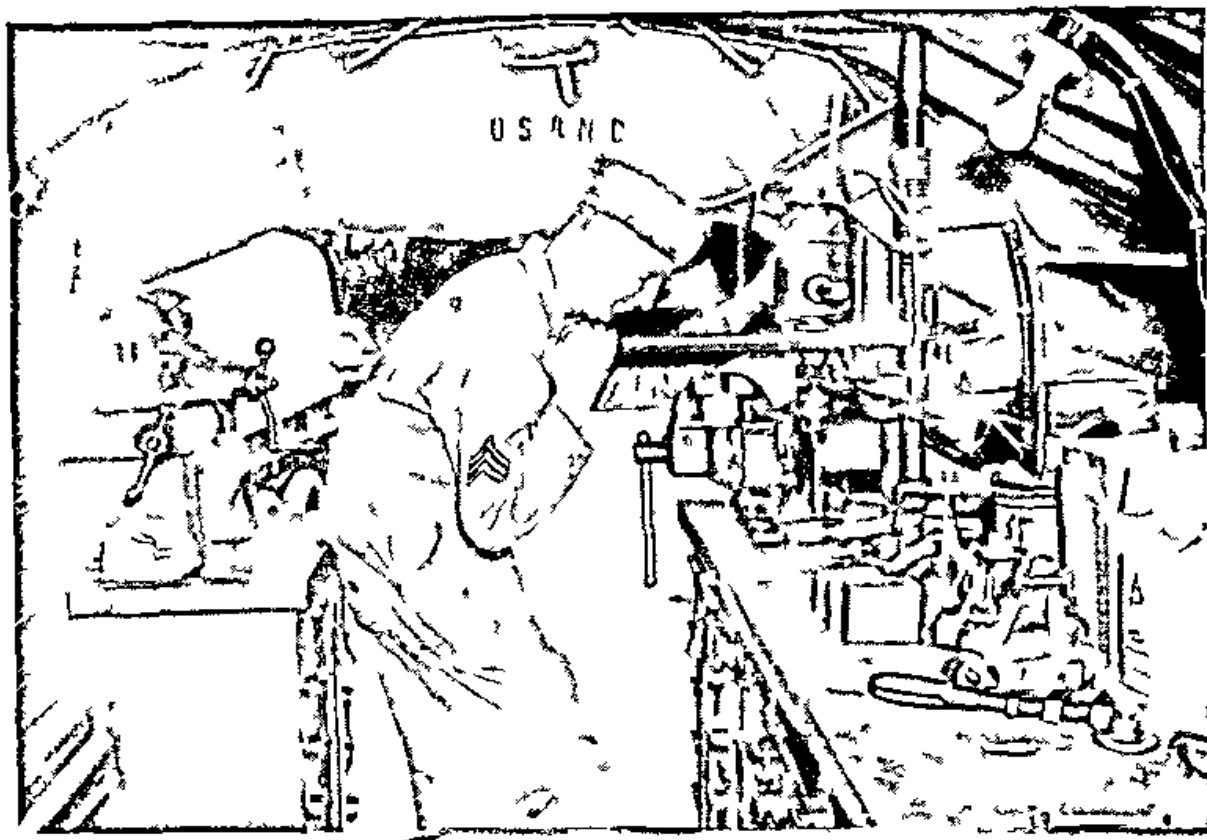




Portable airport defense gun with its twelve shot magazine cylinder removed At the left are three kinds of projectiles tear gas shell one pound bomb and parachute flare



The 1½ inch weapon set up for action Weighing only forty pounds it folds up quickly for carrying

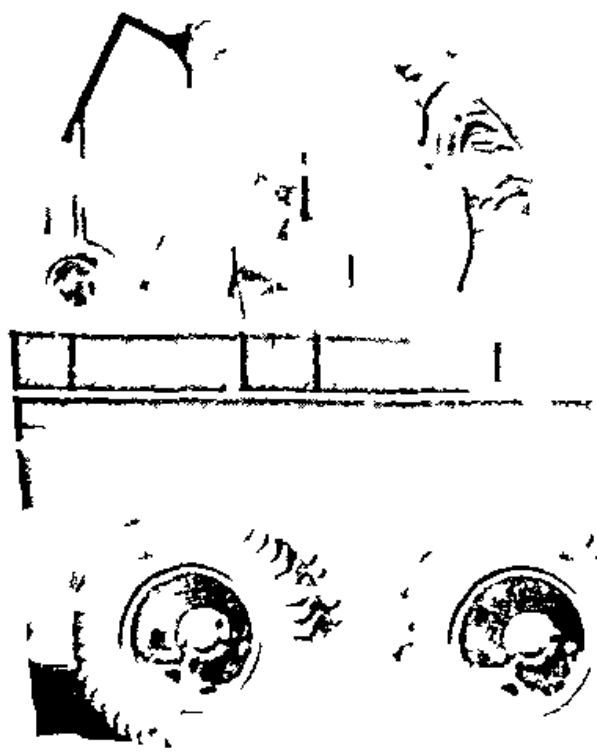


Soldiers in Overalls

KEEP OUR WAR MACHINE ROLLING

AN ARMY officer who has what it takes can make dead tired men march all night and attack in the morning and he can make scared stiff men fight and win when the odds are all against them That s leadership—the most valuable quality that an officer can have But even the best leadership can t make a tank run on a broken track or get mileage out of a car with a cracked cylinder It can t grind the valves of an ammunition truck repair a broken down machine gun or weld the cracked axle of a howitzer Those are jobs for trained and skilled mechanics—for the soldiers in overalls who keep the Army s fighting machines running

While our Army still is dangerously short in the quantity of its mechanized weapons it is long on their quality Our light tanks developed by the Ordnance Department are rated the world s best They have better engines better drives better transmissions and better tracks than any other light tanks they are heavier faster and steadier gun platforms When it comes to the qual ity of their fighting vehicles and their sys



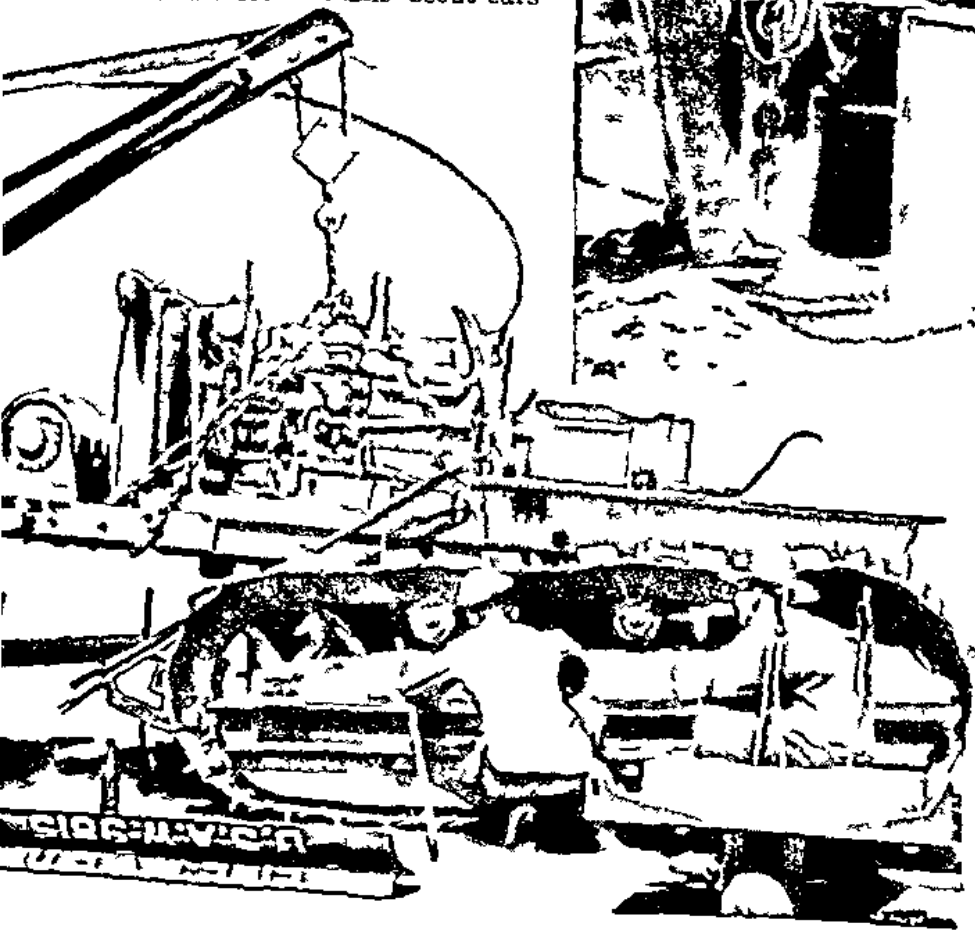
tem of keeping em rolling our mechan ized soldiers don t have to take off their snappy barrack caps to any army in the world

One of the purposes of the Third Army maneuvers in western Louisiana this spring was to give our Regular Army officers their first large scale opportunity of practicing the tactics and solving some of the problems of mechanized motorized and modernized warfare The maneuvers also provided a stiff test of the Army s services of main tenance and supply The mimic war meant two weeks of the hardest kind of work for the 70 000 Regulars who took part in it—especially for the men who had the job of keeping roll ing the over 7 000 motor veh cles wh ch were driven hard both on the roads and off them There was plenty of sweating done—but then as China s General Chiang Kai shek says the more you sweat in peace the less you bleed in war

Following the l ght tanks of the Mechanized Cavalry Br gade—then the most thoroughly mechanized out fit in our Army—as they thundered over the big maneuvers area on their scout ng and combat miss ons I was able to get a close up of the operation of the maintenance system of an or ganization which had 720 vehicles on tracks and wheels—tanks scout cars half tracks trucks passenger cars and motor cycles—and which regards attack ing at daybreak 150 or 200 miles away from where hostile aviation reported it at dusk as just another routine job

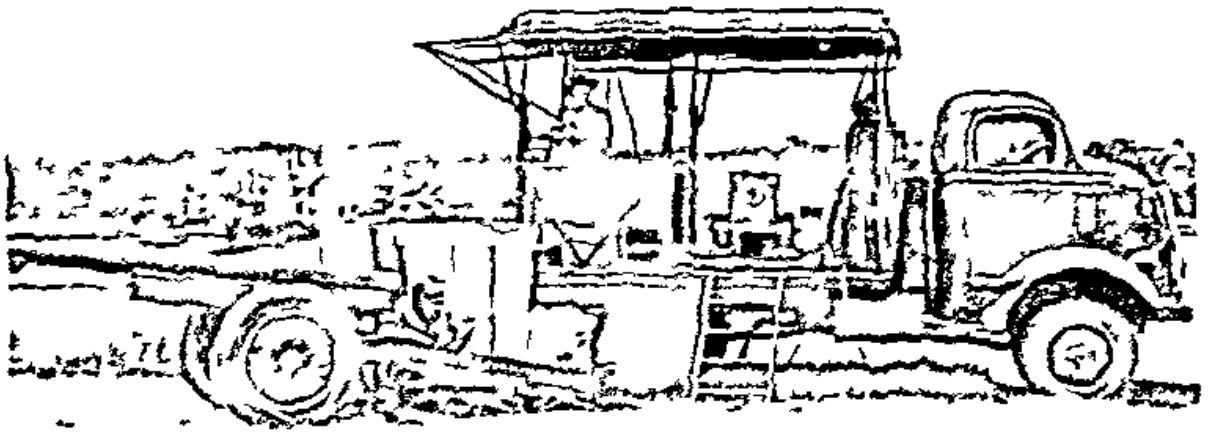
Each troop has a maintenance section which stays with it under all conditions to make minor repairs both on the road and on the battlefield It is commanded by a motor sergeant who is an expert trouble shooter and travels in an armed scout car followed by a truck which carries light re pair equipment a small assortment of spare



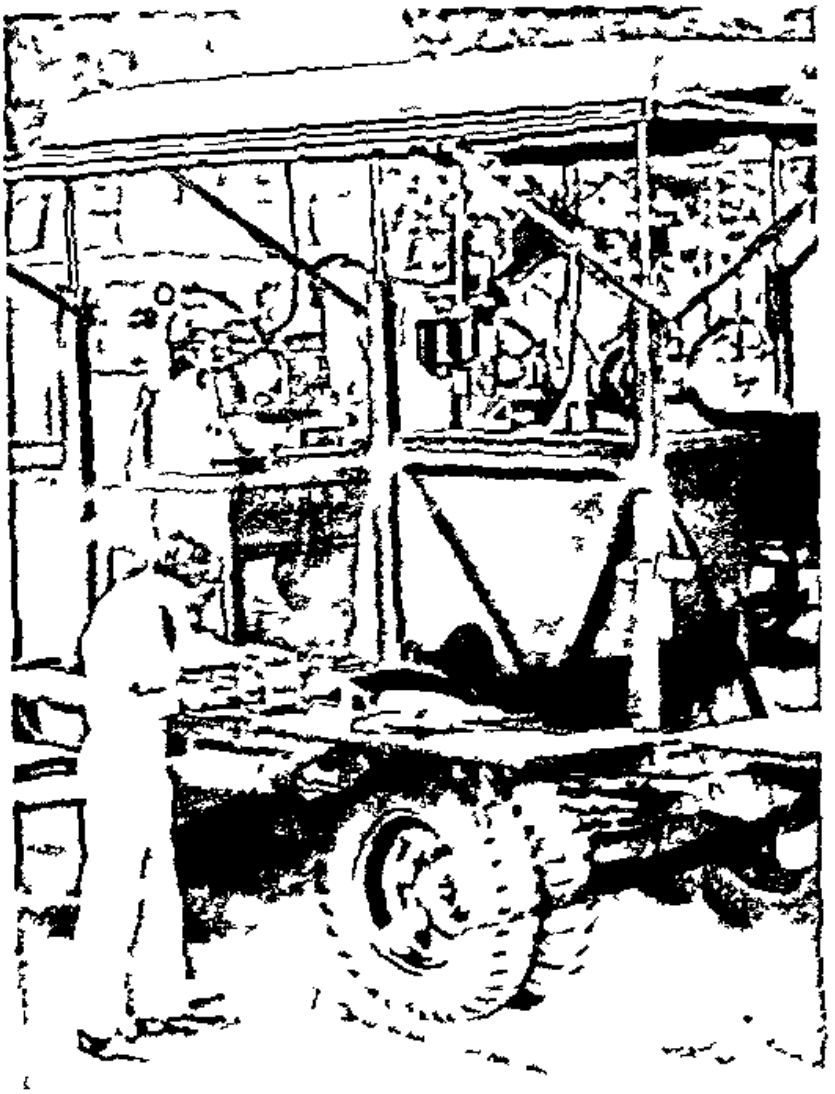


Vulcan s fo ge 1940 style a f eld weld ng shop in act on It follows the ran caval y n a t uck

A b g repa r job on a t actor s all n the days wo k fo f eld ma ntenance men Spare parts and all necessary tools and equ p ment are carr ed



A welding truck halts to repair the carriage of a field gun. Its generator provides current for welding and to drive its power tools. At right an automotive repair-shop truck



parts and an emergency supply of gasoline and oil. When a tank or scout car is disabled it is pushed over to the side of the road and the rest of the troop goes on forward to fight. It is an unbreakable rule that the officer in command must not wait for cripples.

When the troop maintenance section comes up the motor sergeant checks the disabled vehicle and diagnoses the trouble. If he has the time and equipment for the job he makes the repair, takes the vehicle along with him to the next halt, and then sends it forward to rejoin the troop. If he can't make the repair he tags the job with his diagnosis, and leaves it. Its crew always stays with a disabled tank or scout car, so that as soon as it has been repaired they can take it back into action where it belongs.

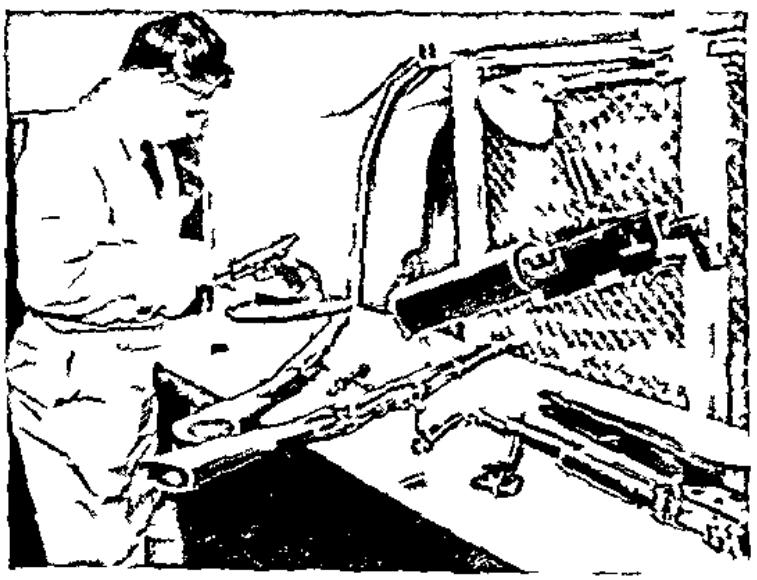
Following the regiment on the march is the regimental maintenance section which carries with it a larger assortment of spare parts and is equipped to handle jobs such as changing tank tracks and installing new shaft assemblies. When it comes up to a disabled fighting vehicle the staff sergeant who is its chief mechanic rechecks the job, and if an immediate repair is practicable leaves a crew to make it. If a roadside repair can't be made he has a wrecker tow the cripple to where the regiment is going to bivouac for the night and the

repair is made there When ta re is fght ing going on a regimental service park is established a few miles back of the combat zone Disabled vehicles are re ported to it by radio and crews are sent out to repair them on the battlefield or to tow them in

Jobs which are too big to be handled by the regimental maintenance sections are taken over by the brigade s ordnance main tenance company which has machine shop trucks welding apparatus and other equip ment which while sturdy is light enough to be carried in trucks This organization can handle almost any repair job even that of install ng a new engine It takes with it into the field two complete engine assemblies for each fifty tanks Its 200 odd highly trained soldier mechanics set up their shop in a big square tent brightly lighted by electricity supplied by a genera tor truck Often they work all night to make good on their boast that if it is humanly possible they always have every disabled vehicle ready to go when the column pulls out in the morning

There will be one of these maintenance companies probably increased in man power in each of the two divisions of the new Armored Corps now being organized Men now are being trained to do this specialized mechanical work of the Army s most modern fighting outfit at schools re cently established at Fort Benning Ga and Fort Riley Kans

As important as keeping a mechanized force s fighting vehicles in perfect mechan ical condition is the job of keeping them supplied with fuel There s nothing in war more useless or more helpless than a tank with an empty gas tank Having a supply of fuel at the right place at the right moment always demands careful planning and often demands hard work Tank trucks have been tried and discarded Now cargo trucks carry the fuel in ten gallon cans which while the column is halted are dropped off at each vehicle This method saves time and time is the



Inter or of a small arms repa r t uck wh ch keeps r fles p stols and ma ch ne guns n good order



The Quartermaster Co ps handles the b g job of feed ng gasol ne to the war mach nes Th s s a f eld depot whe e fuel s put nto ten gallon cans for d st but on by t uck to hungry tanks and tractors

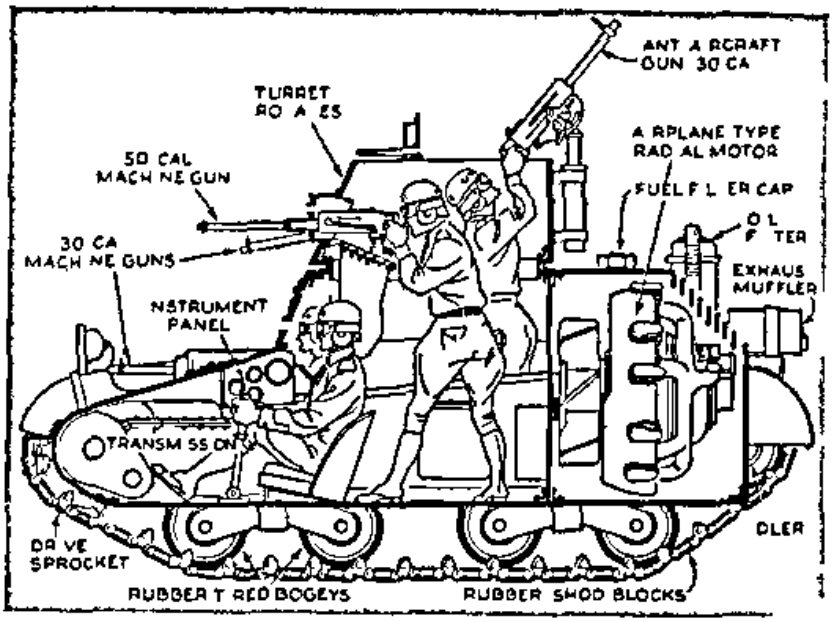
determining factor in to day s warfare

Attached to each of the two army corps we now have organized there is a corps ordnance battalion and equipment is be ng procured for addit onal battalions so that as the expanding Army adds new corps there w ll be a battal on for each of them

Each man in these bat talions is trained to ex pertness in some me chanical operation After he has mastered that part cular job he is trained to handle other jobs All the equipment is carried on trucks and most of it is used on them so the field shops are ready for work a few minutes after the trucks have scattered through some patch of woods which will give them cover against air attacks Included in the equipment are field welding outfits machine shop trucks and special firearms repair trucks which carry extensive assortments of spare parts and the tools necessary for the repair of machine guns rifles and pistols

One of the jobs I watched being done dur ing the Louisiana maneuvers was the weld ing of the broken axle of a 155 millimeter howitzer without taking the big weapon out of its firing position

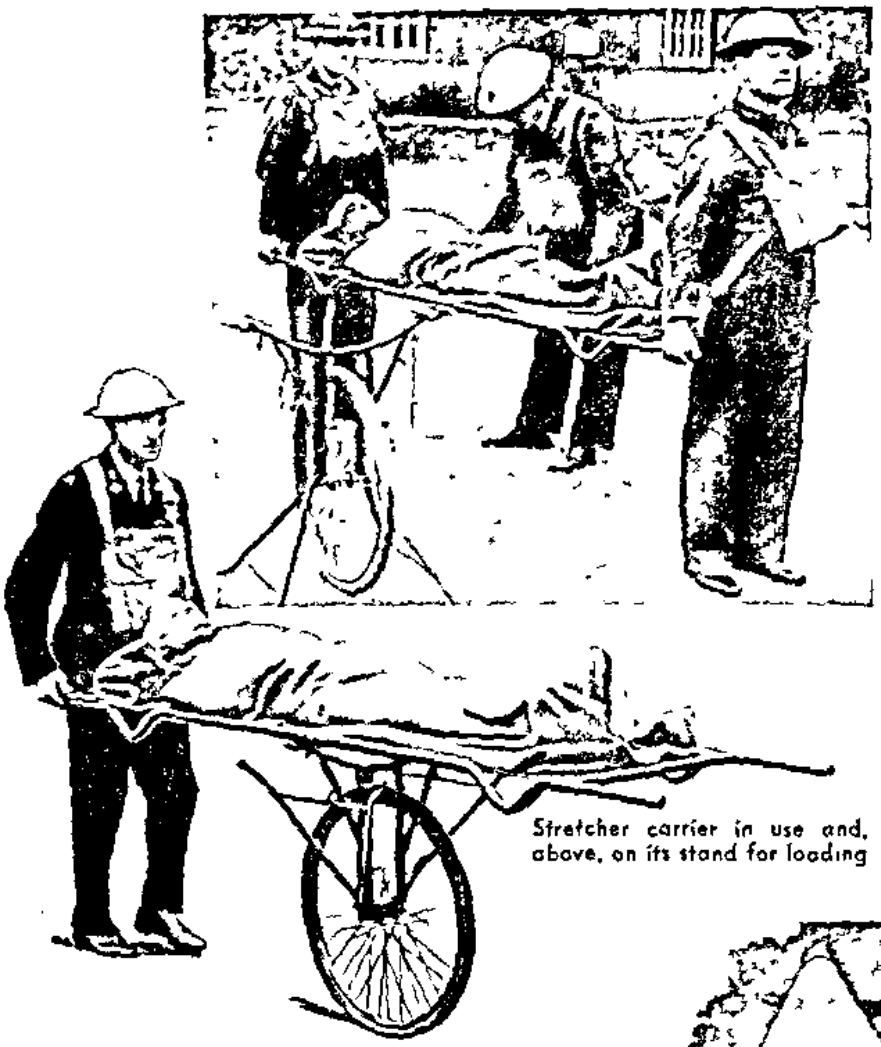
In its various post shops the Ordnance Department has sturdy but comparatively light machine tool equipment capable of doing all the work of a large job shop In war this would be taken into the field and used by ordnance *(Co ntinued on page 232)*



Uncle Sam s f ght tanks are gene al y rated the best n the wo ld The cut away v ew shows one of them w th ts fou man c ew at ts post



Trucks and othe non f ght ng veh cles a e kept n runn ng o de by the Moto T anspo t Serv ce



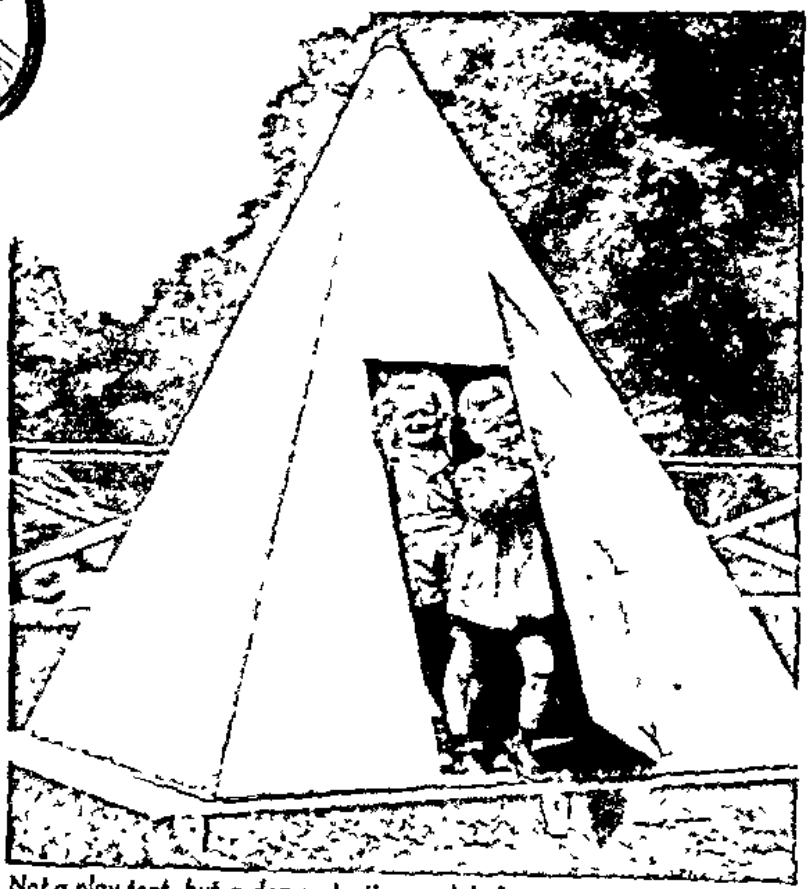
Stretcher carrier in use and, above, on its stand for loading

Stretcher Holder With One Wheel Speeds Rescues

ONE man can trundle an injured person to an ambulance or first-aid station on a one-wheel stretcher carrier designed for use in air raids. Built to fit a standard stretcher, the device uses a bicycle wheel and has a stand to support it when the stretcher is removed. Since it can be operated like a wheelbarrow, the carrier enables a single worker to take the place of two men in moving bomb victims, speeding rescue work in cases where ambulances cannot be brought right up to the scene of the damage, or when a first-aid station is set up near-by.

Mass-Production Air-Raid Shelter Made in the U.S.

APPROPRIATELY shaped like an Indian tepee, what is said to be the first bomb shelter to be produced commercially in the United States was placed on display recently at Quincy, Mass. Made of quarter-inch reenforced steel, the pyramidal hide-out is not intended to withstand direct hits, but is said to be capable of protecting five or six occupants from flying debris. Mass production may soon be started on the shelter, which is a copy of a popular-priced English model that has proved very effective.



Not a play tent, but a demonstration model of an American bomb shelter

Squadrons Right!

HOW WARSHIPS MANEUVER IN BATTLE

WHEN the crackl ng rad o report from advanced scout ng sh ps or planes sends a battle fleet out to sea in search of the enemy how does the Adm ral handle h s float ng fortresses? How do they advance nto bat e What *format ons* do they take and what ma neuvers do they follow?

As far as they relate to Amer ca s m ghty arma da deta led answ ers to these quer es are the jealously guarded secrets of the commanders who have been putt ng our battle forces through *the r paces in long drills* at sea No one outs de of offic al c rcles knows the spec fic maneuvers that the U S Fleet w ll fol low f t s called upon to steam seaward to *pro* te t our coasts or repel a threat d rected at the Panama Canal

But certa n format ons and maneuvers are stand ard among all navies only the combinat ons and elaborat ons of them for spec fic purposes be ng kept under cover In the words of W nston Church ll tw ce F rst Lord of the Br t sh Adm ralty The evolut ons of cavalry n the days of shock tact cs and those of a modern fleet re semble each other both cavalry and fleet dr ll cons st pr marily in swift and well executed changes from one forma t on to another



The bas c tactics he cont nues call for a fleet to approach n a compact mass and then deploy *into a long column to* fight so that all guns can be trained over one s de for a withering blast at the enemy The d agrams on this and the following pages illustrate some of the major format ons and maneuvers used by battle fleets to gain a tact cal advantage over the r op ponents in the deadly game of war at sea

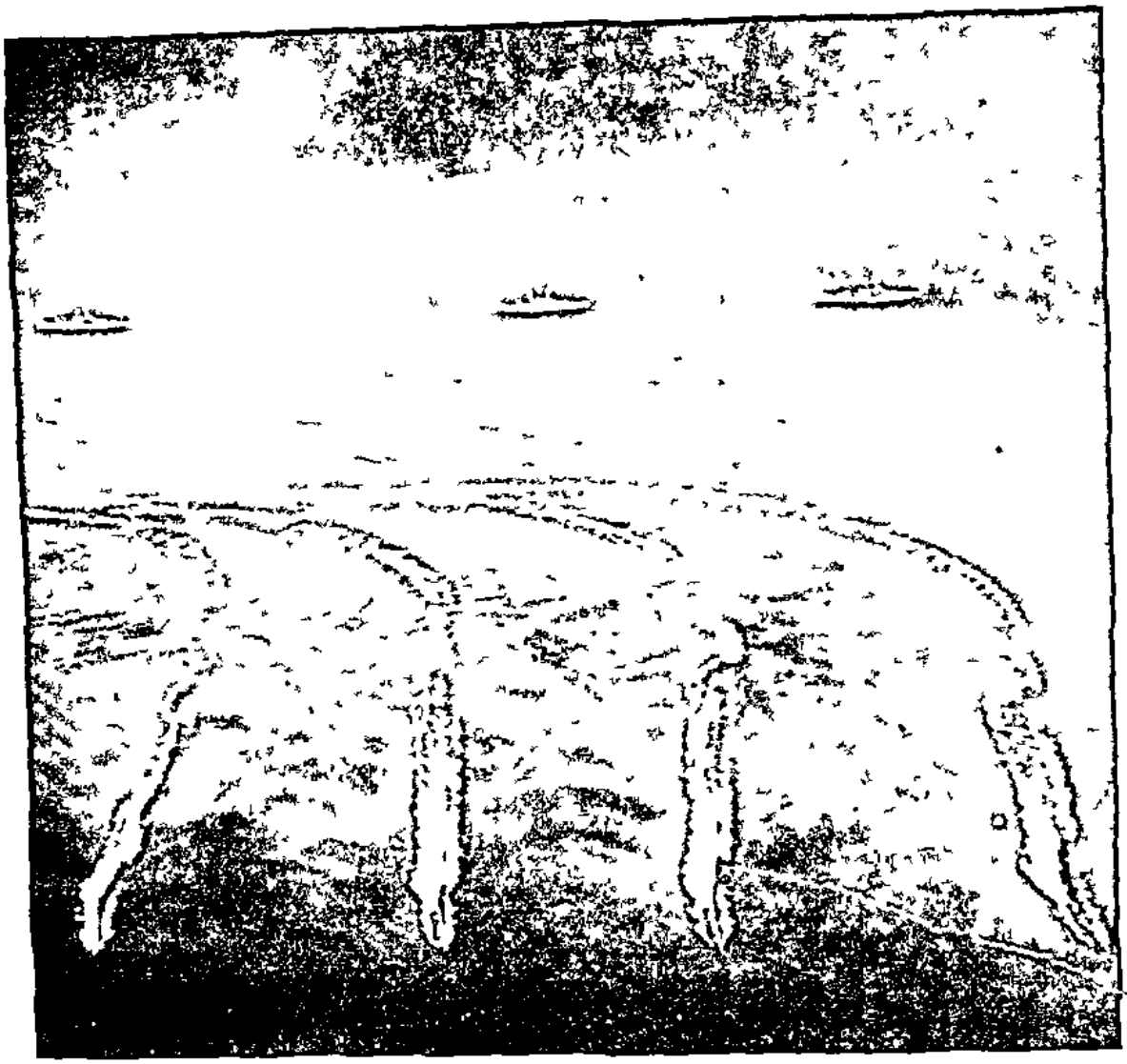
THESE ARE STANDARD CRUISING



SHIPS N COLUMN In a tuo batt e th s fo mat on enab es a l the h ps to b ng the b oad des to bea s mu oneou y on the enemy

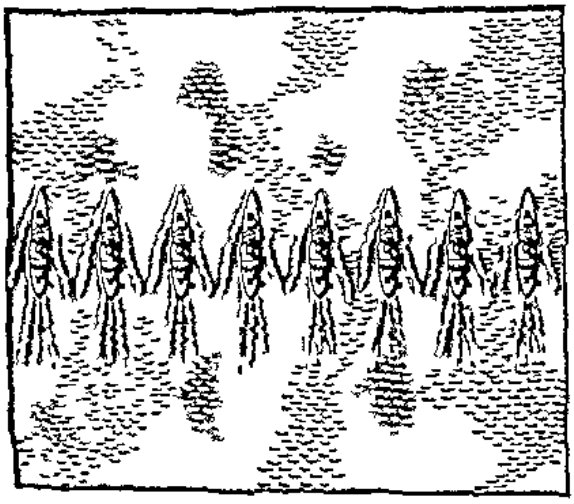


LINE OF BEAR NG 45 DEGREES He e the sh p a e steam ng on pa a e cou es w th one end of the l ne fa n ad once of the othe

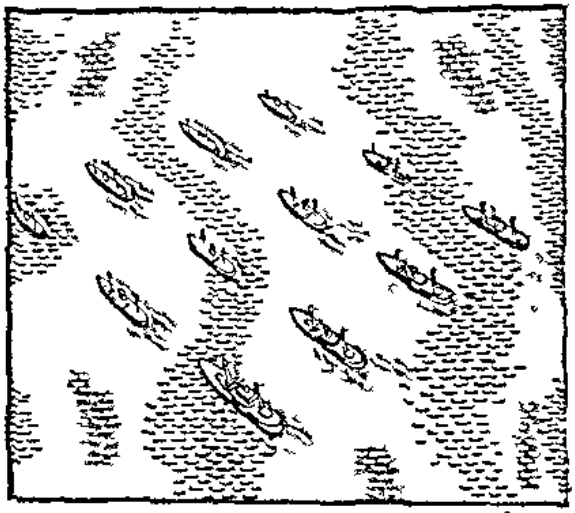


Leaving tracks of foam U S warships on maneuvers execute a neat turn from column formation into line

FORMATIONS OF A BATTLE FORCE



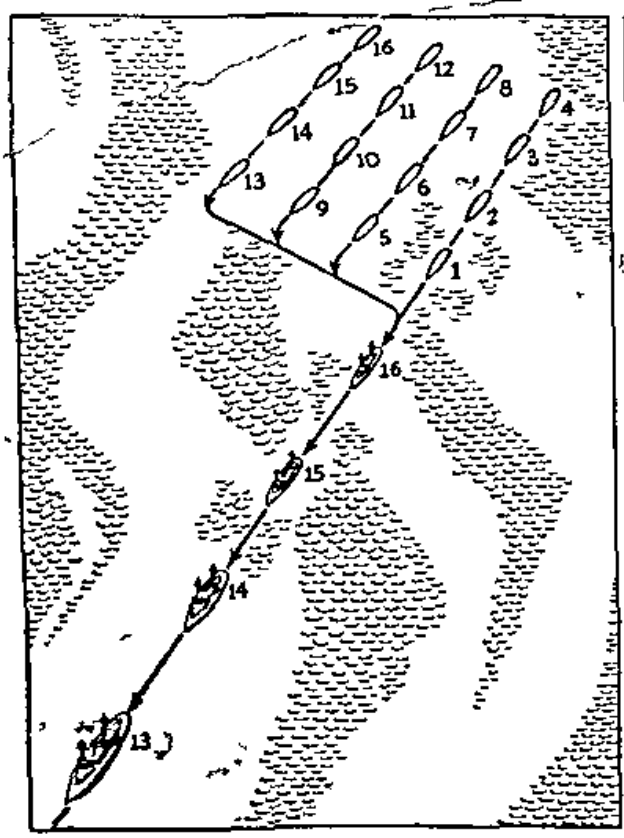
SHIPS IN LINE, or line of bearing 90 degrees This formation can be used for approach, but it would be fatal to be caught so under fire



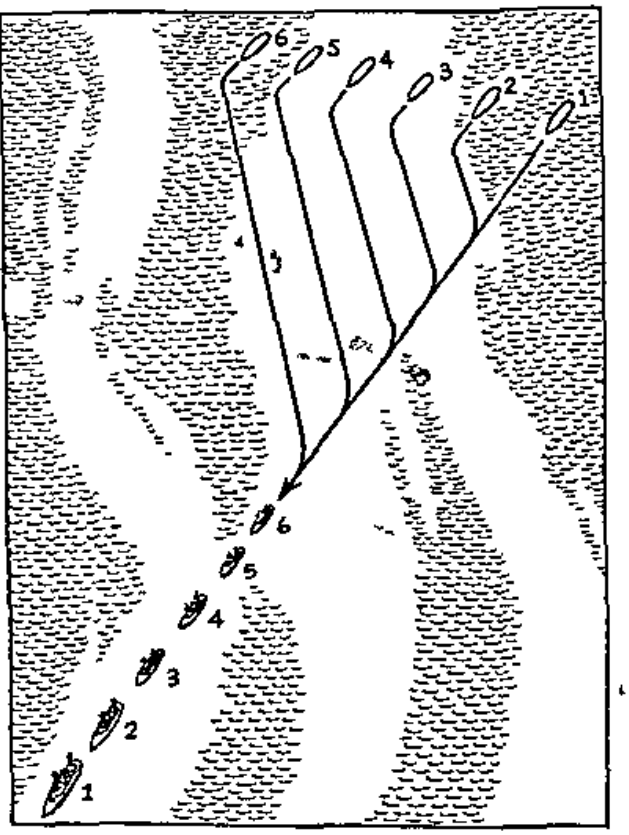
COLUMN OF DIVISIONS Here the fleet is steaming in column of fours It can easily swing into a single column, as shown on the next page



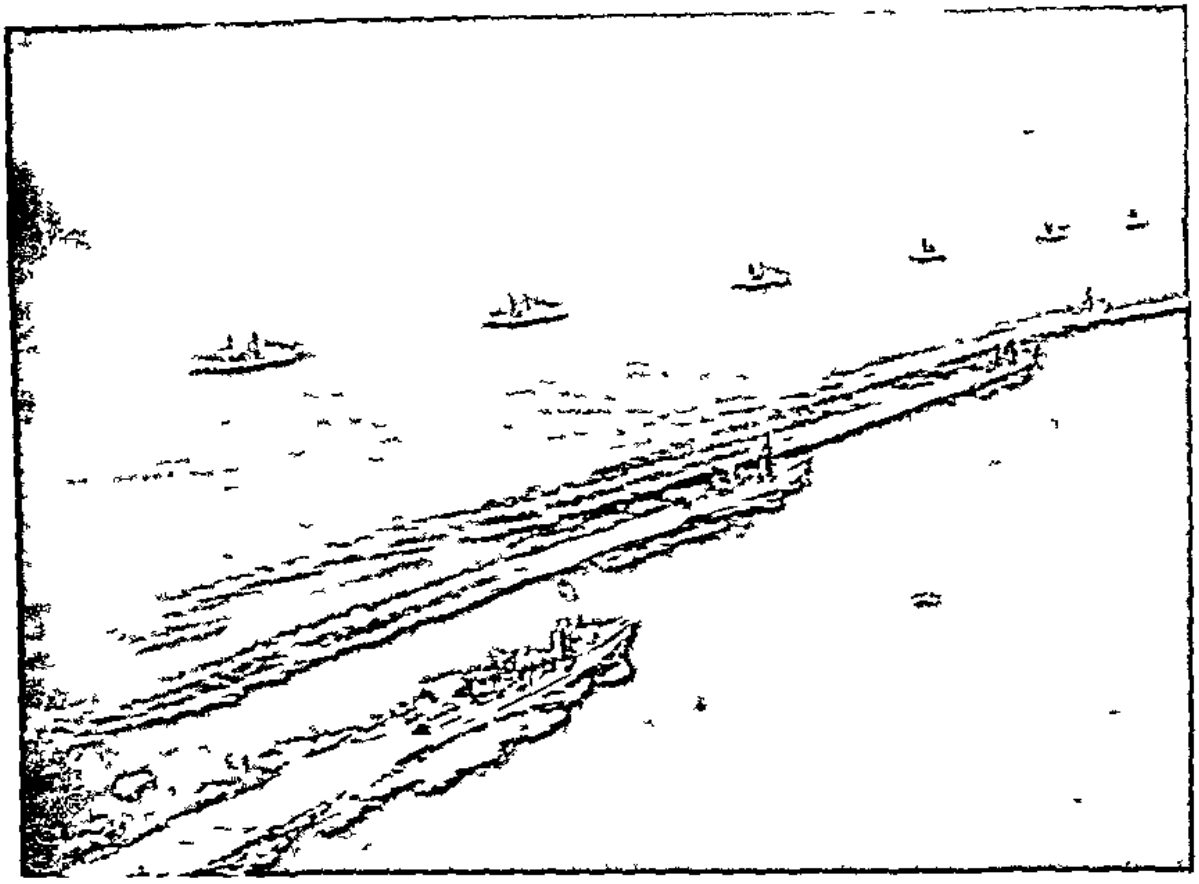
Seen from the sky through wisps of cloud, three columns of ships symbolize America's growing sea power



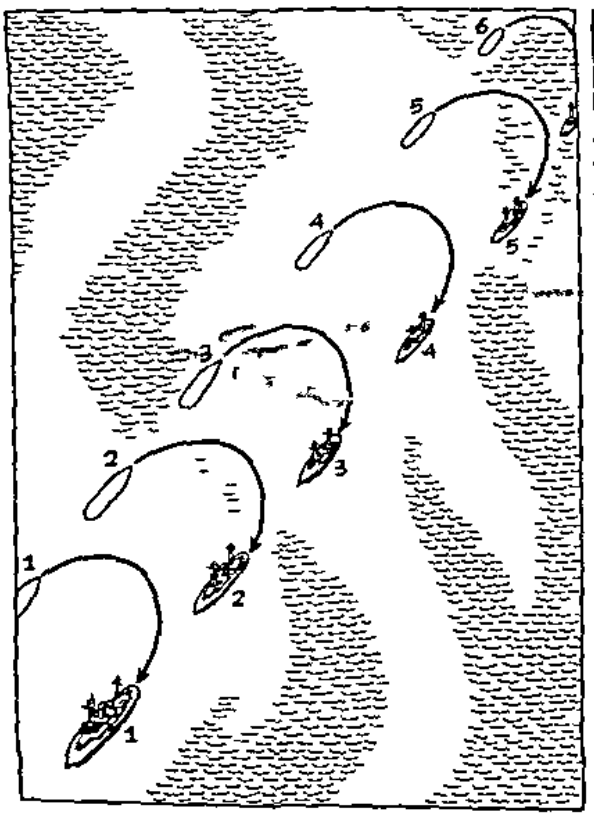
DEPLOYMENT FOR BATTLE. This maneuver, for bringing ships into single column was used by the British at the Battle of Jutland in 1916



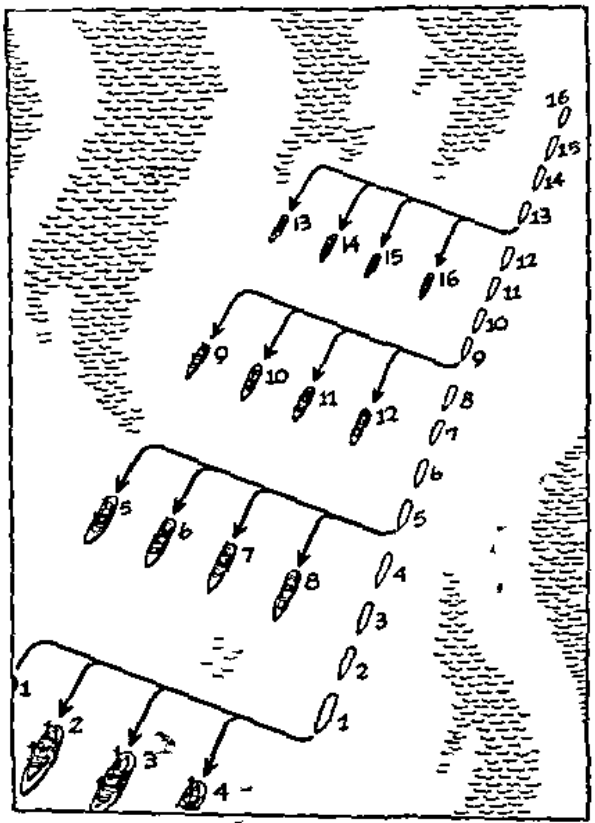
FROM LINE INTO COLUMN. With the precision of a football squad executing a signaled play, the battle wagons wheel into their places



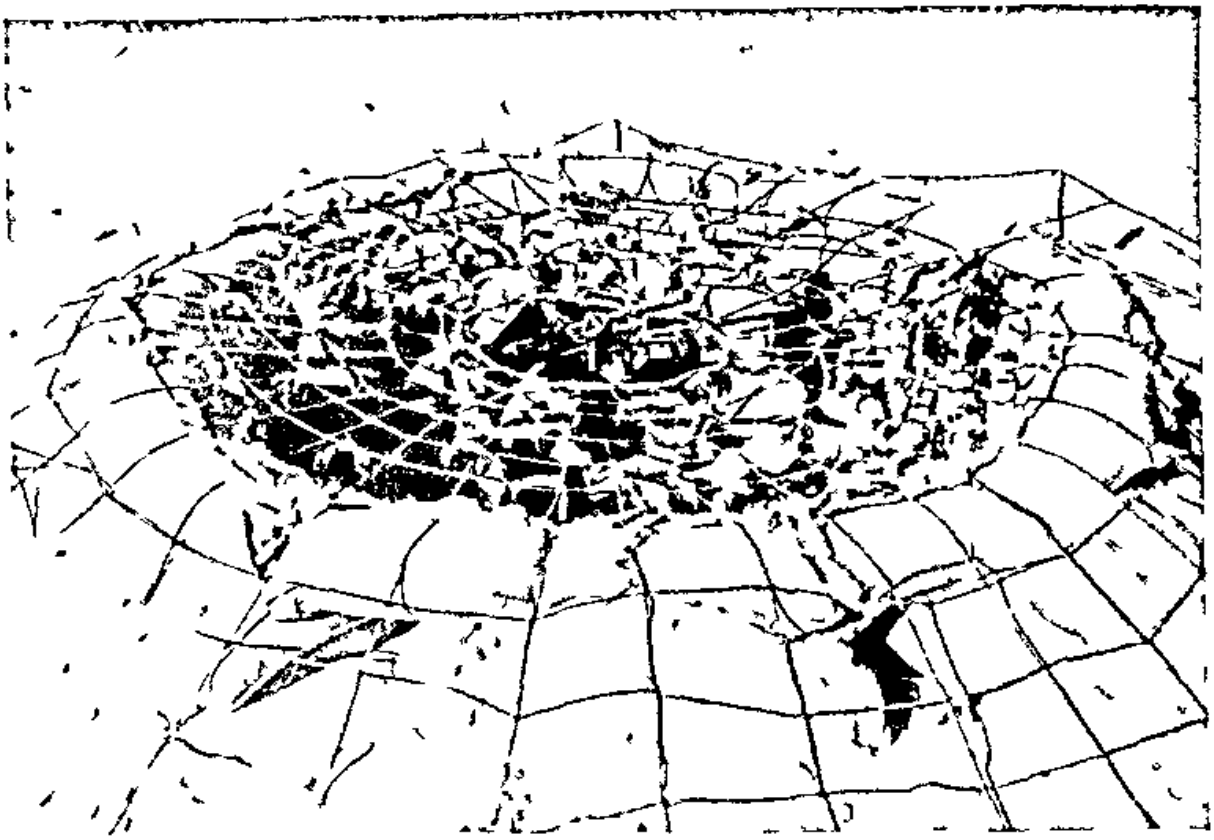
Fast cruisers slice the waves to place a protective screen along the flanks of the big battle wagons



SHIPS RIGHT ABOUT This is a quick way to reverse the direction of a column of ships Each vessel turns sharply and falls into place

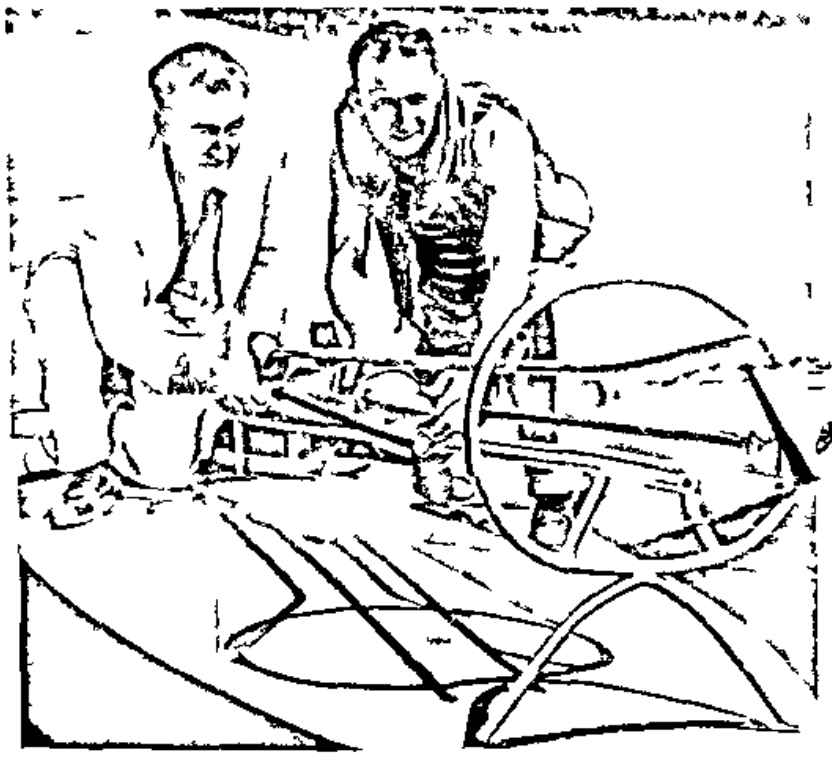


COLUMN TO COLUMN OF DIVISIONS To make this change of formation the ships of each division swing out and form into a line abreast



Wire and Burlap Camouflage Desert Nest for Gunners

BLENDING into its desert background the British Bren gun post pictured above serves both as protection and as camouflage Located somewhere in the Near East the circular post concealing the light rapid fire gun is made of piled sandbags covered with a spider web of cords on which shreds of burlap have been hung for concealment



Fleets of these speedy torpedo boats could defend coastal waters

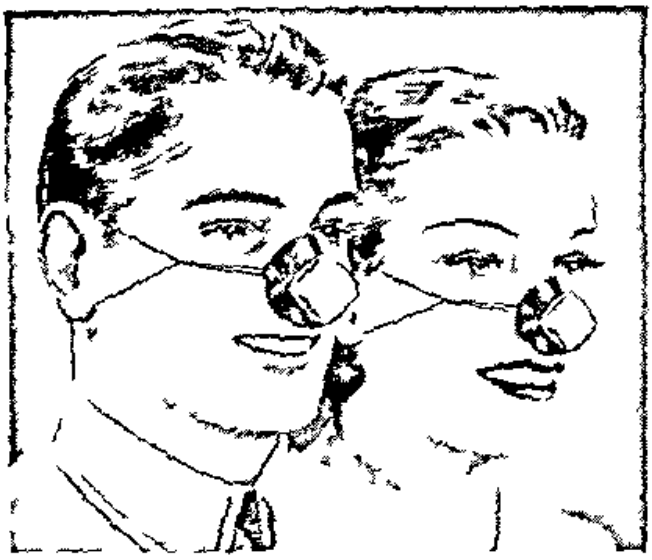
Tiny Torpedo Gun Arms Outboards for Coast Defense

TINY torpedoes can be launched from the decks of small outboard racing boats by means of a novel device tried out recently [illegible] Long Beach Calif [illegible] boat deck [illegible] ework sup[illegible] a tubular steel track along which the torpedo is propelled and launched into the water by powerful coil springs Hundreds of privately owned outboard boats it has been suggested could be equipped with the torpedo throwers to form a potent emergency defense fleet for the protection of coastal areas



"Chess Game" Directs Air-Raid Defense

LIKE players at a giant chessboard offi ers at the air defense control center seen n the unusual photograph above are plot ing the moves of hostile aircraft Through eadphones plotters seated around the ible map receive reports of unidentified anes and formations from field observa tion posts and mark their positions and courses with counters Supervisors wield ing wooden rakes rearrange the counters to form a complete picture of the general situation Observing the map from a platform in the rear tellers telephone information to air force commands



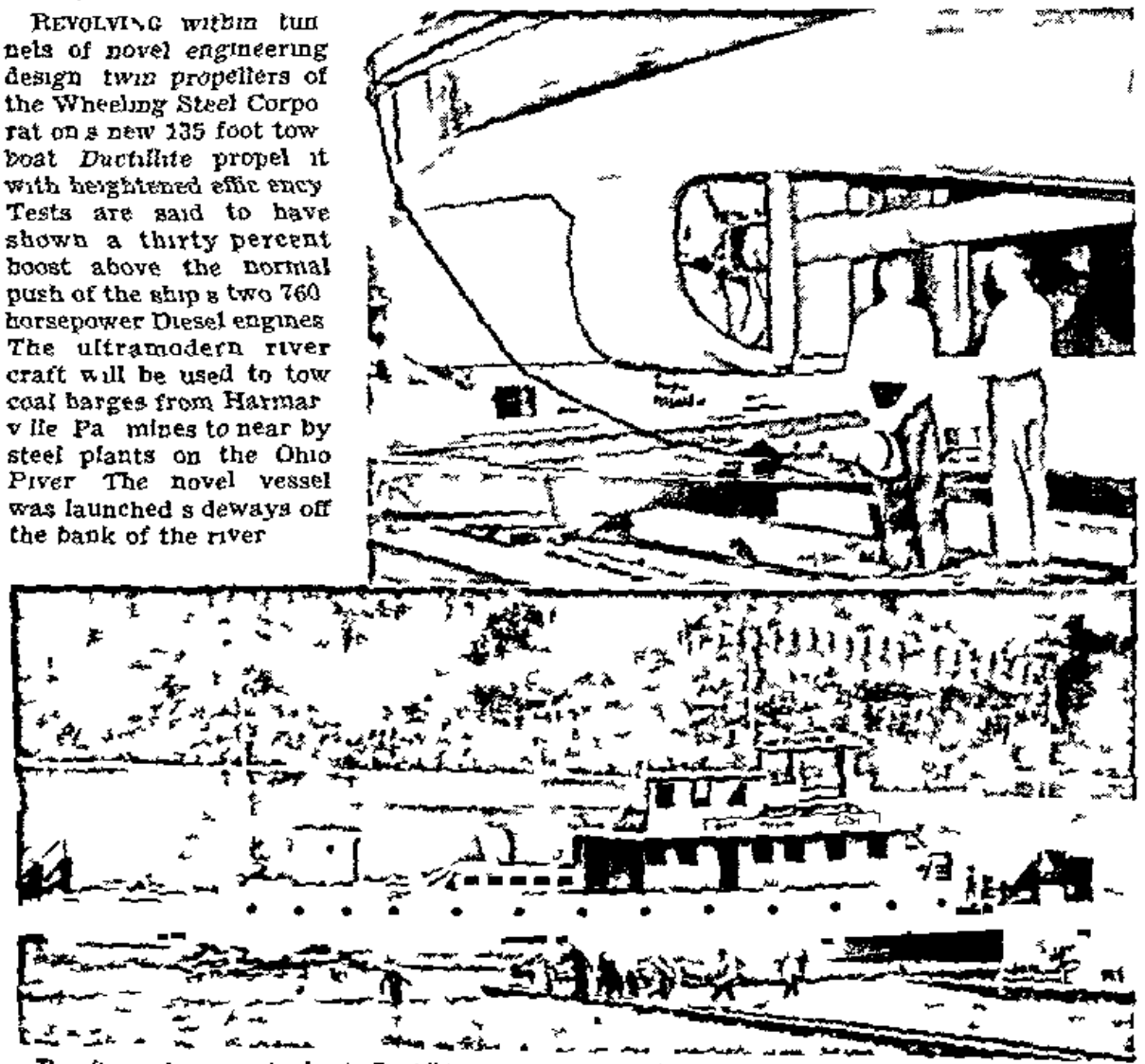
Tiny nose masks do not interfere with talking or eating

Vest-Pocket Respirator Guards Workers' Lungs

SMALL enough to be carried in a vest pocket a one ounce respirator protects industrial workers against dust with new convenience The unbreakable soft rubber device covers the nose alone so that a wearer can talk eat smoke and don glasses or goggles While the user breathes naturally through his nose an ingenious valve exhausts stale air and allows only filtered air to enter Although the replaceable filter folds to wafer size its effective area of nine square inches assures easy inhalation Elastic ear loops hold the respirator

Propeller Tunnels Boost Power of Ohio River Towboat

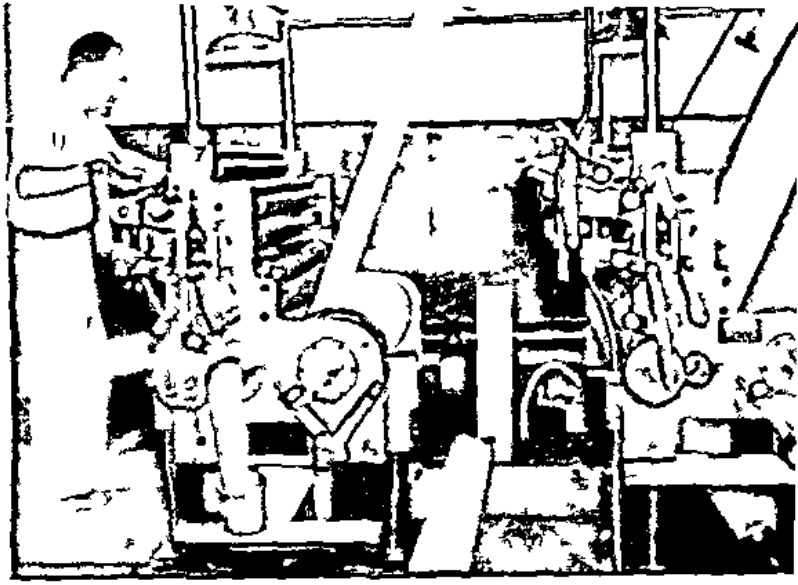
REVOLVING within tunnels of novel engineering design twin propellers of the Wheeling Steel Corporation's new 135 foot towboat *Ductilite* propel it with heightened efficiency Tests are said to have shown a thirty percent boost above the normal push of the ship's two 760 horsepower Diesel engines The ultramodern river craft will be used to tow coal barges from Harmarville Pa mines to near by steel plants on the Ohio River The novel vessel was launched sideways off the bank of the river



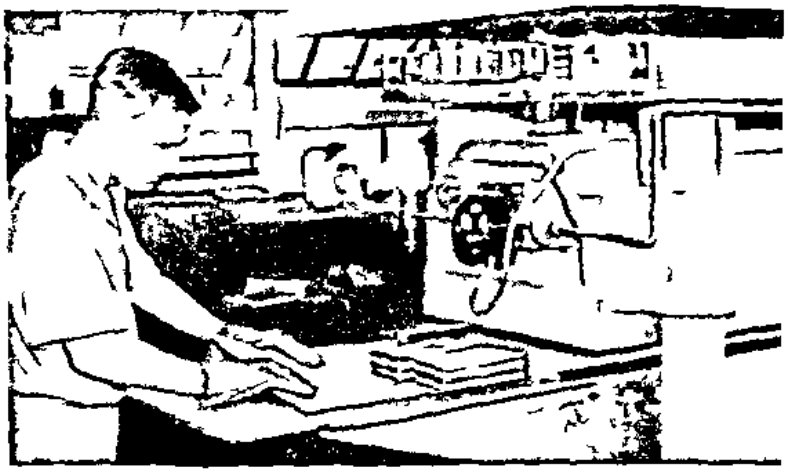
The ultramodern towboat *Ductilite* as she appeared just after her recent launching The upper view taken when she was still on the ways shows one of her twin propellers in its novel tunnel housing

Rubber Plates for Rotary Press Speed Up Printing and Cut Costs

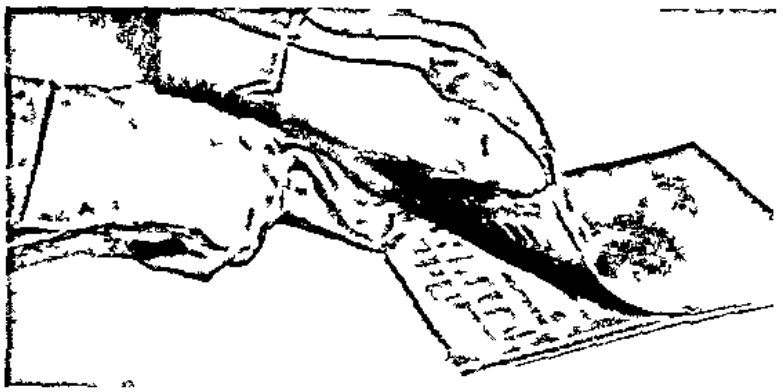
PRINTING plates made from a specially compounded rubber are a new development that is expected to speed up the printing process and at the same time cut down its cost. With the new process type is set by hand or machine and then transferred to a plastic matrix or mat, by means of a hydraulic press The rubber printing plate is then made from this mat First a sheet of the special rubber is placed in contact with the type marked plastic mat Next a sheet of spring brass is placed over the sheet of rubber Then the combination is placed in a powerful hydraulic press for a period of five minutes The result is a rubber printing plate vulcanized securely to a spring brass backing This combination can then be bent around the cylinder of a specially designed rotary press for high speed printing According to the manufacturers the rubber printing plates have many advantages They print clearly at all times even the finest type losing none of its definition They wear longer than metal plates having shown little wear after special tests when they were employed in making as many as 200 000 impressions The rubber plates can be used to reproduce line drawings or half tones if specially prepared The plates cost about the same as electrotypes or offset plates but they reduce printing costs due to the increased speed of rotary press printing and to a saving in the cost of making plates ready for the press Because of their affinity to ink the plates are said to print with less ink than metal plates Duplicate rubber plates can be made from the plastic mat in only five minutes



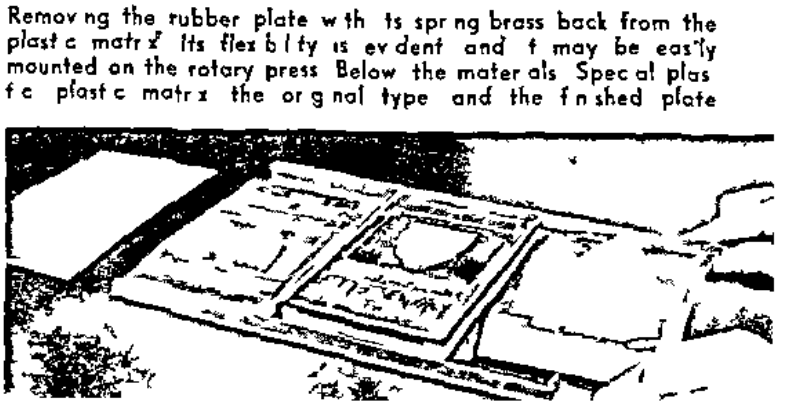
Outlasting metal plates brass backed rubber plates on the rollers of this special press will print over 200 000 impressions

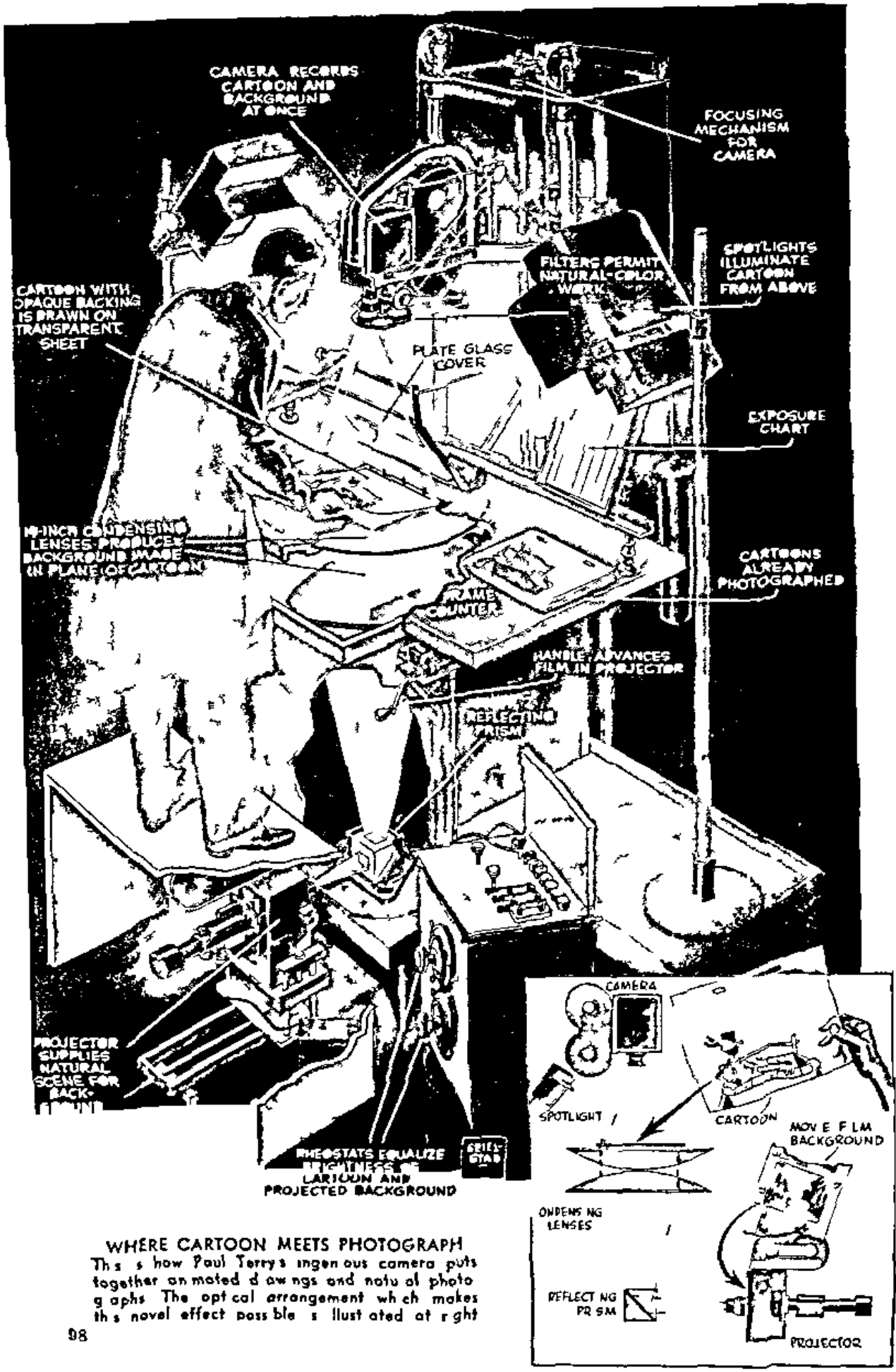


From a plastic mold made from conventional type an impression is cut to be taken on a rubber plate under pressure and heat



Removing the rubber plate with its spring brass back from the plastic matrix Its flexibility is evident and it may be easily mounted on the rotary press Below the materials Special plastic plastic matrix the original type and the finished plate





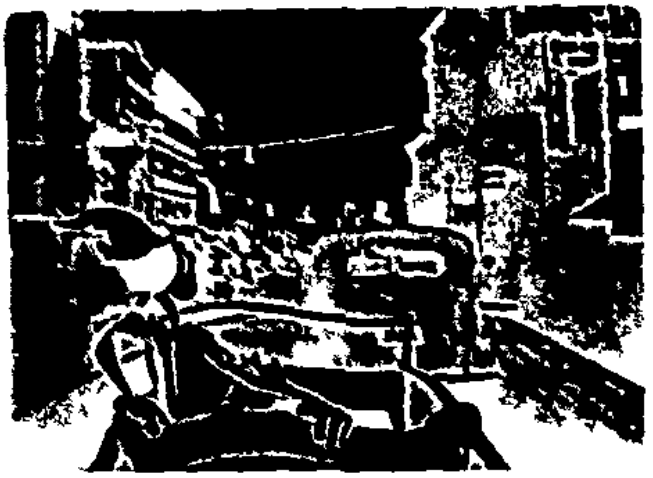
WHERE CARTOON MEETS PHOTOGRAPH

This is how Paul Terry's ingenious camera puts together animated drawings and natural photographs. The optical arrangement which makes this novel effect possible is illustrated at right

New Cartoon Camera

COMBINES DRAWINGS AND PHOTOGRAPHS

A REAL car with a flesh and blood driver rolls sedately along a busy city street Careening behind it a caricature of an Indian in a speeding jallopy performs antics that would whiten the hair of a traffic cop Trick photography produces animated movie cartoons of this novel sort combining hand drawn characters with natural backgrounds in the studio of Paul Terry at New Rochelle N Y



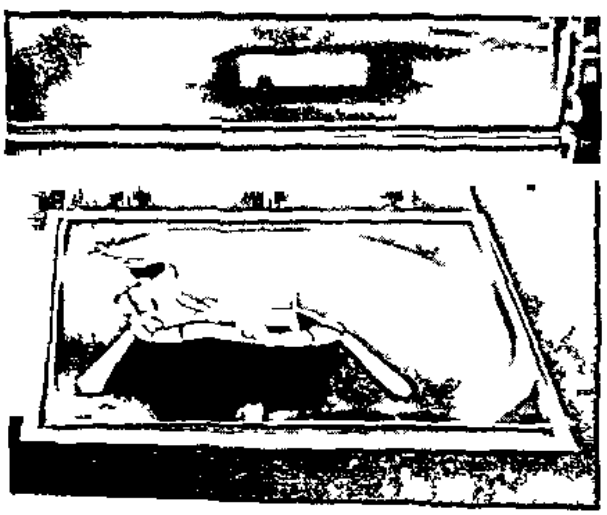
The new system creates queer scenes like this

In making the 6 000 separate cartoons that go into a typical 500 foot animated film the artist uses a special procedure Each figure or object is drawn on top of an opaque silhouette of black or white pigment applied to a transparent sheet of celluloid Hold it up against the light and you will see only the black outline of a figure by reflected light its details appear So each cartoon receives the illumination of a pair of spotlights from above while a stop motion camera photographs it Meanwhile the opaque cartoon effectively blocks out the unwanted part of a real movie scene which is projected from below through the transparent part of the celluloid The rest of the background automatically is photographed with the cartoon giving a composite picture For each succeeding frame the same procedure is used after cartoons and background scenes have been shifted

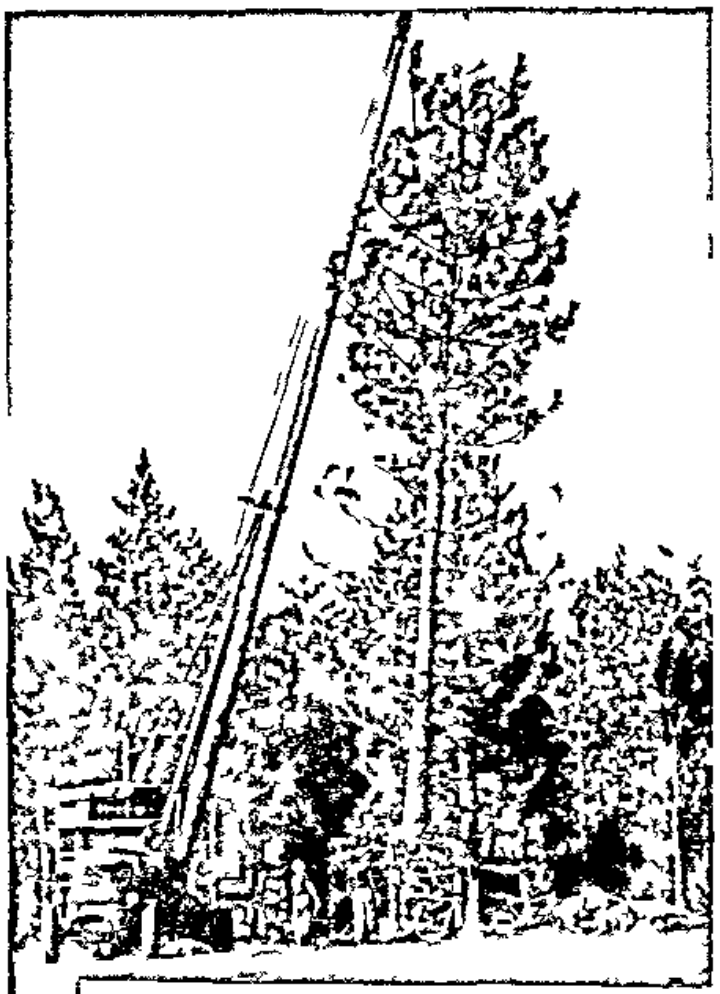
Simple as the scheme may appear in principle its practical realization required an optical set up so original that it has been awarded a patent To match the size of an artist s drawing background pictures on standard movie film had to be greatly enlarged Through the reflecting prism illustrated—which simply serves like a mirror as a space saving device—a projector could have thrown the film image upon a screen of ground glass. By scattering the light however the screen would make the system relatively inefficient and slow Therefore Terry substituted a huge pair of nineteen inch condensing lenses the most costly part of the whole apparatus for the ground glass They form a brilliant invisible image which can be seen only by the camera s lens or by placing the eye in exactly the same position unless a translucent screen is temporarily inserted for focusing Since this background image can be adjusted to fall exactly at the level of the cartoon the camera easily brings both to a sharp focus Light regulating controls adjust the illumination from spotlights and projector until they balance and all is ready for picture making

Rapid and economical the new process will make animated cartoons either in black and white or in full color For the latter purpose a set of color separating filters occupies a rotating mount over the lens Every full color drawing with its corresponding background of color film is then photographed through each filter in turn

Lighted from above the drawing is picked up by the camera and masks the background



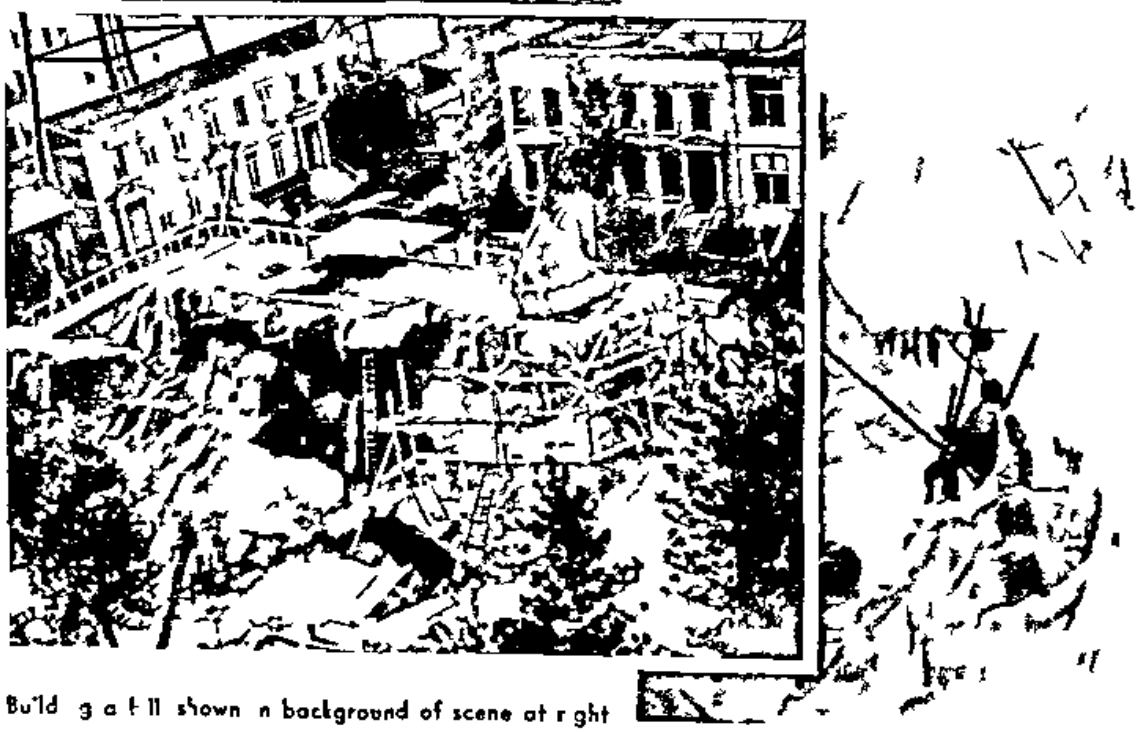
Hollywood Moves



COMPLETING in eight days what nature requires two generations to accomplish, nurserymen and movie studio workers recently trans planted a forest of pine trees from southern California mountains onto the Paramount studio lot in Holly wood 100 miles away Men work ing in twenty four hour shifts cut the trees and in 100 truck loads dispatched them down a winding mountain road from Arrowhead to the movie capital. Larger than any trees ever to ride the highways they measured up to ninety seven feet tall

H E Buettner foreman for a nursery concern faced the unusual ly difficult problem of lowering the trees 600 feet down a steep moun tainside and delivering them on the set without breaking their branches

Left one of the 350 t ees hauled f om 100 m les away s set up by a boom t uck on a Hollywood mov e lot



Bu'ld g a t ll shown n background of scene at r ght

a Forest

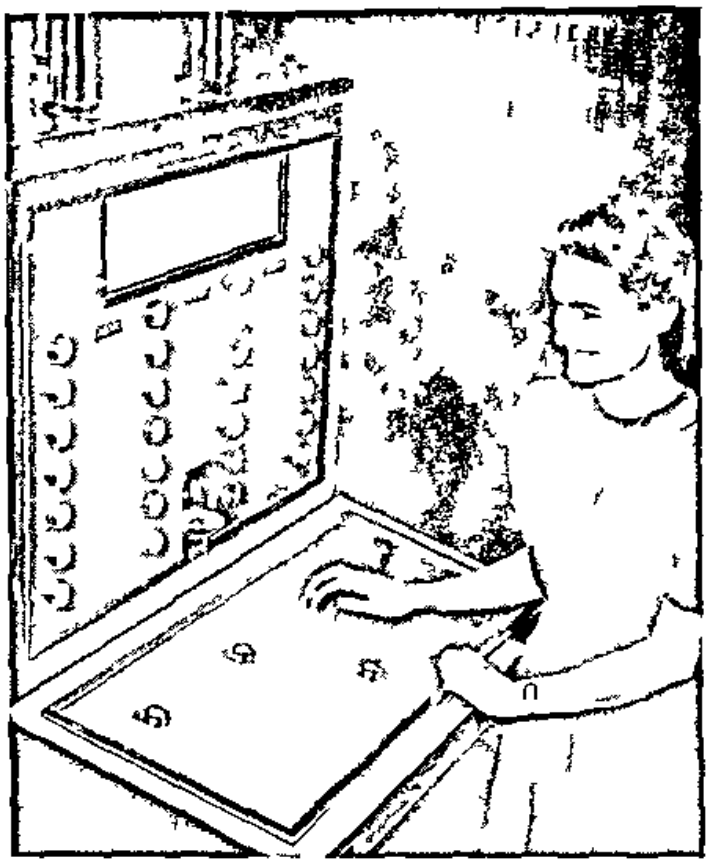
for full color scenes in North west *Mounted Police* He suc ceeded by skidding them to the waiting trucks on an elevated cable way then blocking them up on the truck floor over an inverted V made of timbers Although some trees overhung nearly fifty feet, few branches were lost.

Carpenters erected the movie forest by placing each tree in a huge wooden Christmas tree stand Some of the trees stood on a synthetic hill made of wood and plaster Others were planted on top of sound stages and a water tower both to hide the structures and to give the illusion of distance The set covered nearly six acres Hundreds of tons of earth were moved to create the uneven forest like terrain Forest rangers were stationed to guard against fire



Among obstacles to mov ng the trees was th s steep mounta n h ghway down wh ch they we e successfully brought





Play ng the anc ent Ch nese game of n m w th the mach ne

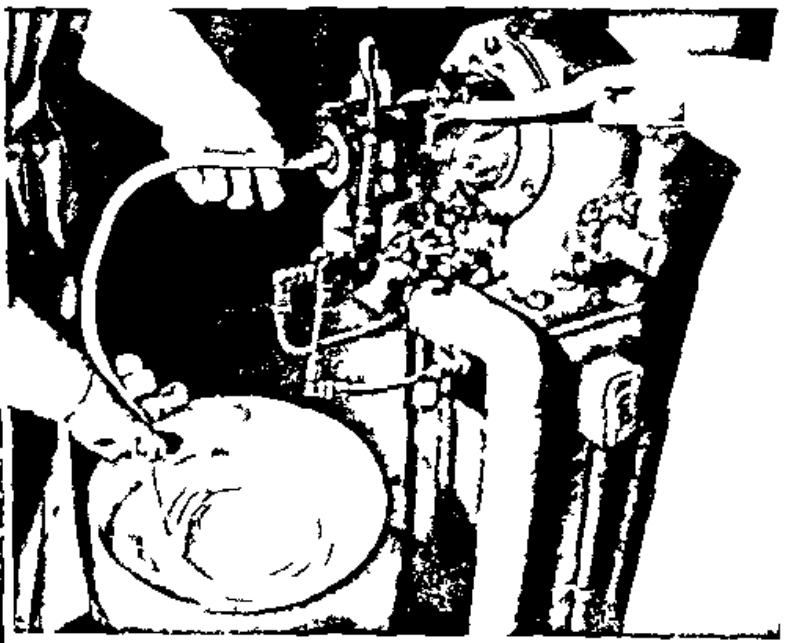
Playful Machine Is Hard To Beat at Own Game

A PLAYFUL, one ton electric brain exhibited by Westinghouse engi neers challenges all comers to the ancient Chinese game of nim Red blue yellow and green lamps extinguished by pushing buttons replace counters drawn from stacks in the original game A player first turns out as many lamps in one row as he chooses Then the ma chine operated by 116 relays takes its turn This goes on until the ma chine or its opponent turns out the last lamp winning the game Since one wrong move means certain de feat a player has small likelihood of beating the robot by chance But he is sure to win if he can think fast and accurately in what mathe maticians call powers of two of the binary system of numbers" The baffled automaton then pre sents h m with a pocket token

New Synthetic Rubber Is Made Directly from Petroleum

MADE directly from petroleum a new kind of synthetic rubber helps relieve U S dependence on fore gn sources for a vital raw material Named butyl rubber the product shown below in its pecul arly shaped raw state has been placed in semicom mercial production by the Standard Oil Company of New Jersey for auto tires and other purposes From this and different types of syn thetic rubber including Amer ipol Neoprene Koroseal Phofilm Thiokol and American buna de fense experts now can choose a variety with characteristics best suited for the par ticular use to which it will be put



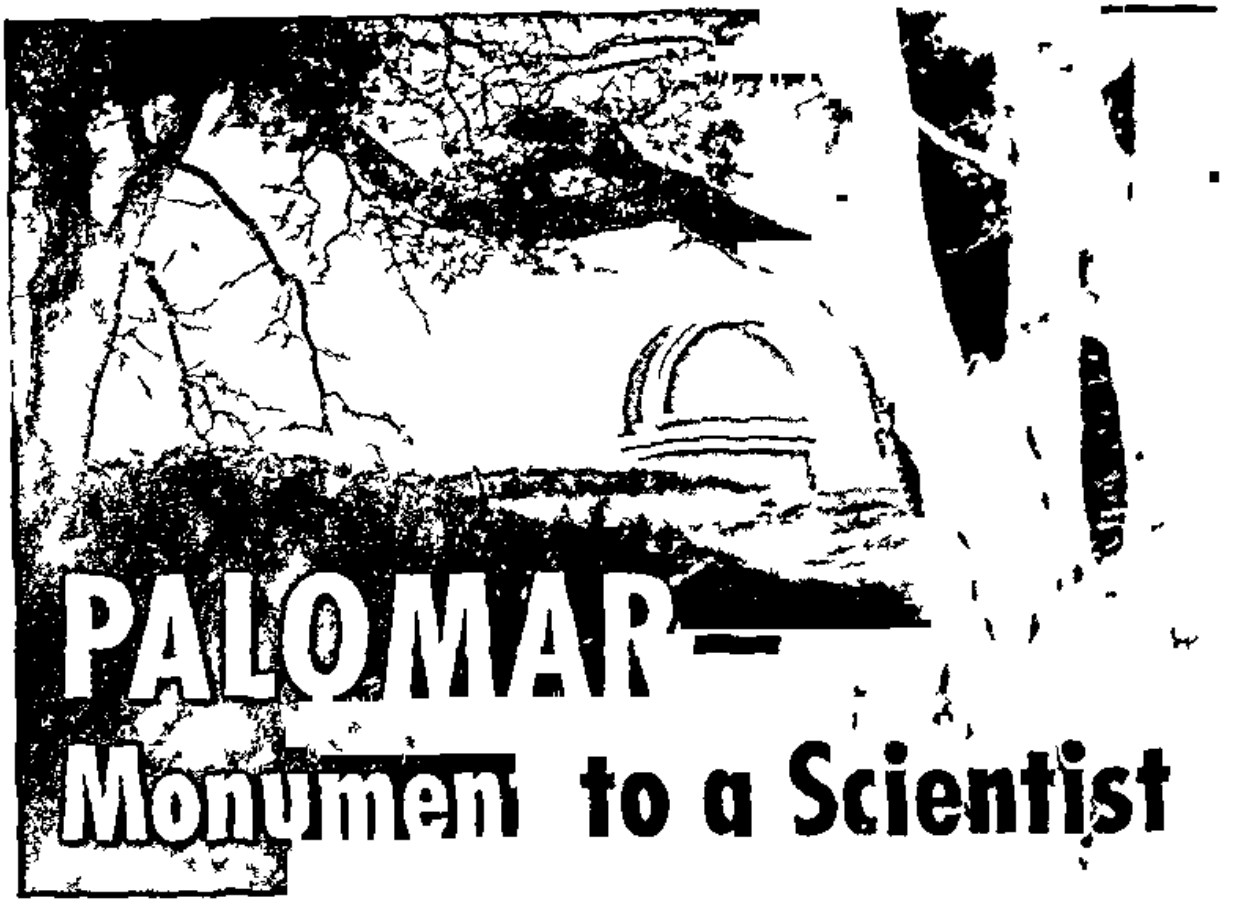


Look ng l ke heads of caul flowe the raw butyl synthet c rub ber s shown at left Above a mach ne converts t nto tub ng



Giant Atom Gun Gets Final Check-Up

IF YOU think this man is putting an enormous stack of pies into an oven you're mistaken. Actually he's searching for any possible leaks in one of the world's biggest vacuum tubes. At its top by means of a glow discharge a new University of Pennsylvania atom smasher liberates electrified particles of heavy hydrogen or helium. High voltage electrodes hurl these bullets downward through the cylinder. When they hit the material chosen for the target at the bottom they are traveling at speeds up to 18 000 miles a second! A near by tunnel offers observers a refuge from deadly rays



PALOMAR—Monument to a Scientist

From the Book, The Glass Giant of Palomar

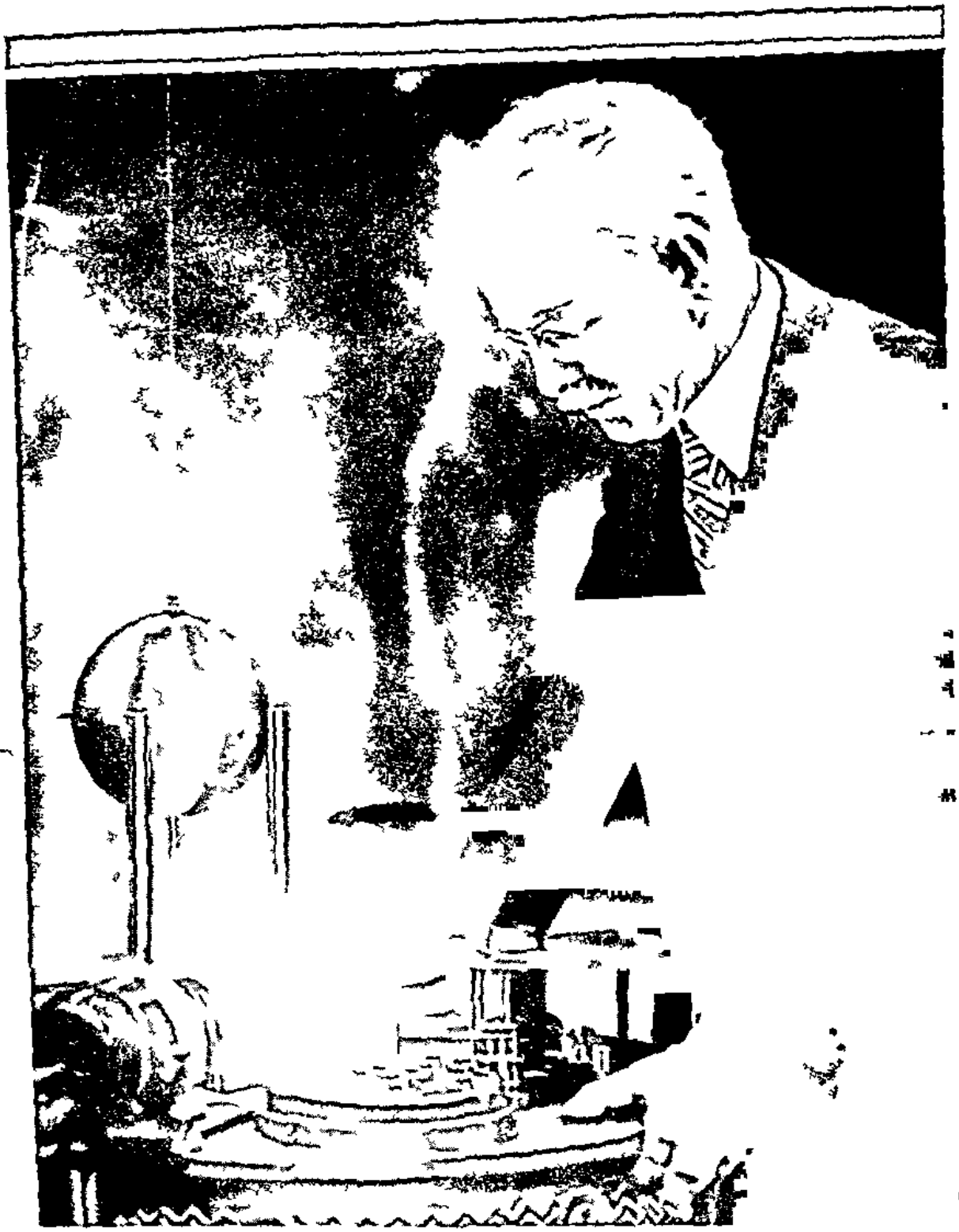
By DAVID O. WOODBURY

SEVENTY years ago the great romancer Jules Verne told of a gigantic reflecting telescope which would follow the flight of a projectile fired from the earth to the moon Twelve years ago Dr George Ellery Hale founder of Mt Wilson Observatory in California improved upon Verne's prophecy in the design of a 200-inch telescope Today a mile above the Pacific on the top of Palomar Mountain this glass giant is nearing completion Soon its great aluminum coated mirror will be turned upon the heavens dragging billions of now invisible stars out of obscurity It began as one man's dream It will stand as a monument to that dream and that man

THE story of the glass giant of Palomar goes back to the year 1881 George Hale the thirteen year old son of a well to-do manufacturer of elevators in Chicago Ill had decided to build a telescope His father gave him the money willingly and he hurried off to buy a small lens which he mounted in a homemade tube It was a pretty crude affair but it decided his career He would be an astronomer

A little later he heard of a telescope with a four inch lens that was for sale second hand He explained to his father that he wanted to study the spectrum of the sun The elder Hale again put up the money and George mounted the instrument on the roof of the family residence

In his freshman year at the Massachusetts Institute of Technology young Hale made arrangements with Director E C Pickering of the Harvard Observatory to take care of some of the instruments and use them when the astronomers did not want them There he got his first actual training in the observation of the heavens Almost at once his vigorous young mind struck off into pioneering territory By the time he was a junior he had invented an important new astronomical instrument the spectrohelio graph which photographs the sun by the light of one chemical element at a time It was not until two years later after he had graduated and was installed in a back yard observatory of his own which his father had built for him in Kenwood a suburb of Chicago that he was able to make his innovation work satisfactorily With the aid of a nineteen year old photographer named Ferdinand Ellerman Hale was able to photograph for the first time in history the towering flames of the prominences shooting 500 000 miles up from the solar rim



DR GEORGE ELLERY HALE father of the three greatest astronom cal ob servator es in the world—Yerkes Mt W'lson and Palomar At the t me of h s death in 1938 his last and greatest achievement the 200 inch telescope at Mount Palomar in Cal forn a was well on the way to complet on

In the same year the young astronomer was married His wedding trip carried him to the Lick Observatory in California Soon afterward he visited Europe and found the fame of his spectrohel ograph had preceded him At twenty three he was already con sidered an authority on the sun After a year abroad spent principally studying in Berlin under Helmholtz Planck and other famous phys cists he returned to Chicago

Although he was then only twenty four his friend President Harper of the newly founded University of Chicago made him associate professor of astrophysics It was not long before George Hale and Harper were deep in plans for an observatory big enough and complete enough to carry the astronomer s researches to their logical con clusion The l ttle twelve inch telescope in his Kenwood observatory was satisfactory only for preliminary studies He had been deeply impressed with the thirty six inch instrument at Lick It was then the world s largest and Hale had come home with an ambition to own one like it Once provided with a *large* telescope he could indeed lead the world to something new

ABOUT this time Hale attended a scien tific meeting in Rochester N Y Pure ly by chance he overheard somebody talk ing to the great lens maker Alvan G Clark Clark was in a quandary The University of Southern California was sponsoring a scheme for outdoing Lick and building a telescope even larger than the thirty six inch instrument. After two huge forty inch disks were in Clark s workshop ready for grinding word came from California that an expected gift of money to pay for the lens was not forthcoming The University couldn t even pay for the glass. Clark was out of pocket $20 000 and as there was no one else in America who could possibly af ford such a telescope the great disks were likely to be left on his hands orphan

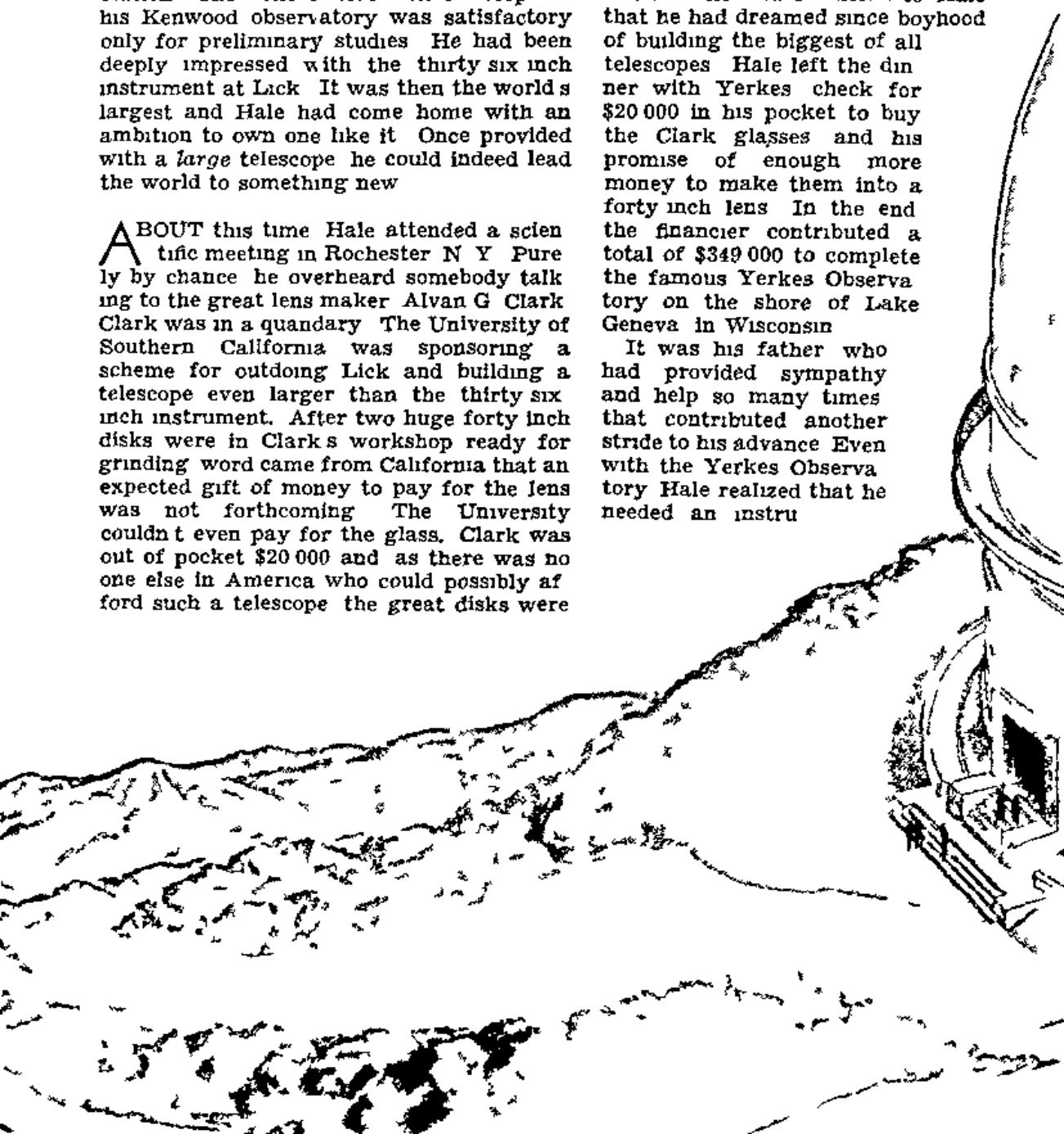
Hale rushed back to Harper with th news Ready to their very hands he saic were glass disks large enough to make th most powerful telescope in the world Bu where was the money to come from?

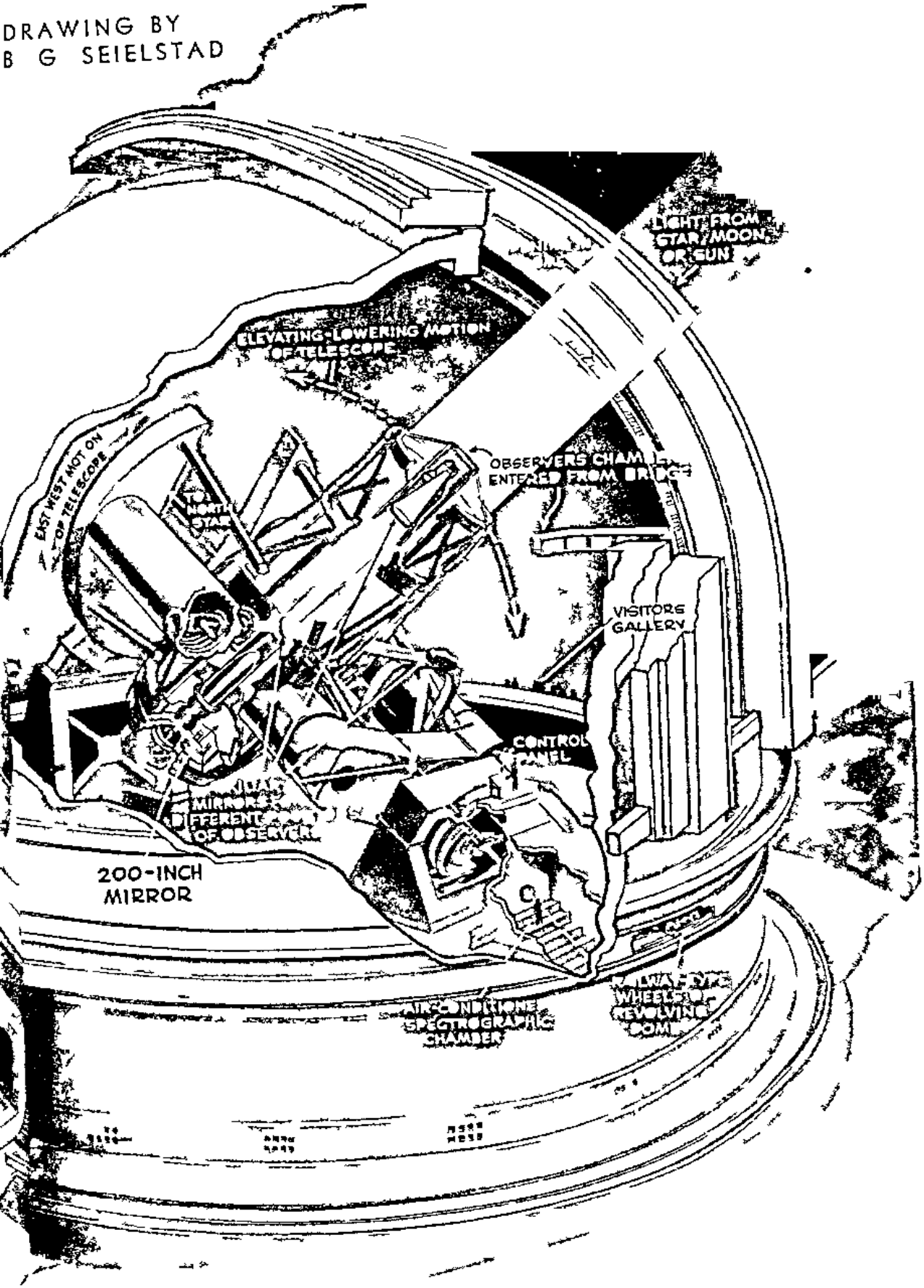
What are you going to do? Harpe asked

See Charles T Yerkes said Hale

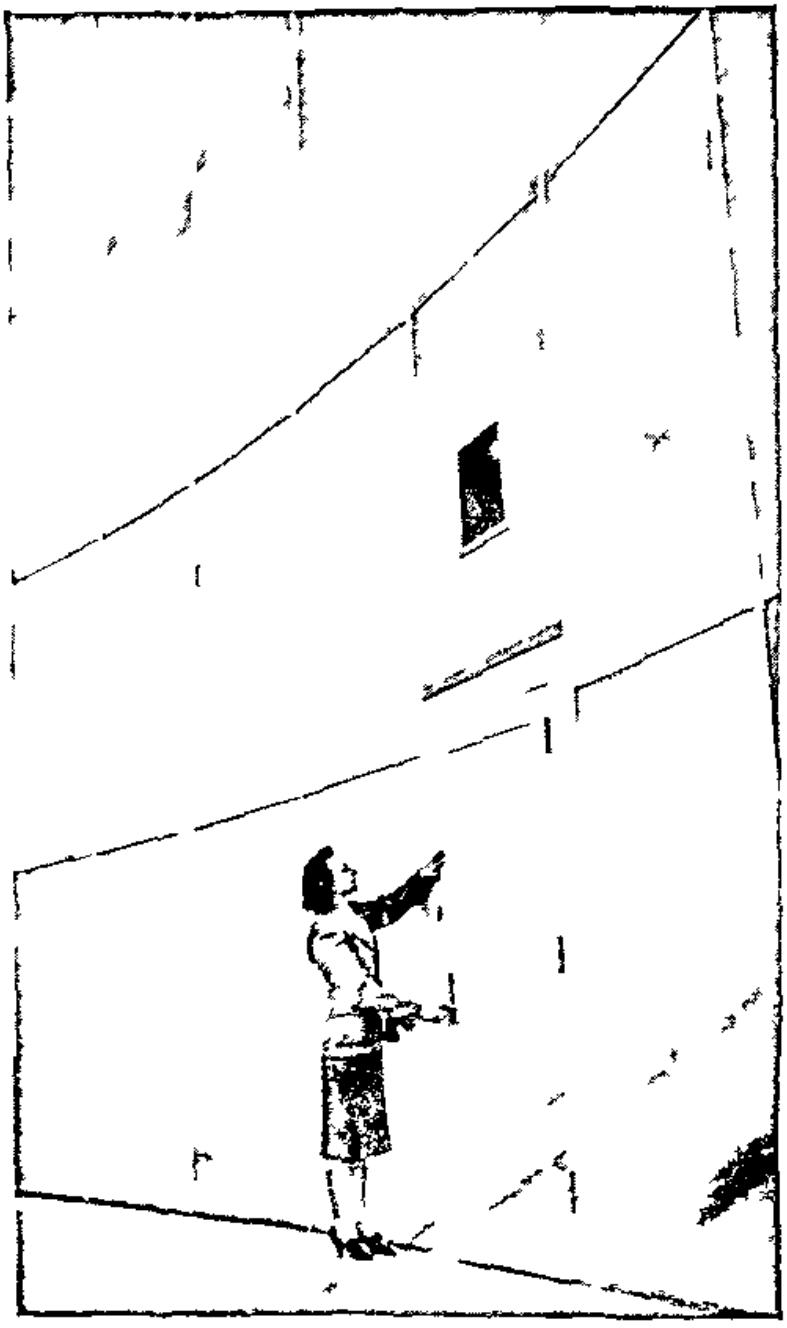
Yerkes was one of Chicago s most wealth men—and most influential Hale laid hi plans carefully He got himself invited to dinner that Yerkes was to attend and con trived to sit next to him Then he bega talking astronomy Yerkes soon became fascinated This young man with his vivid interest in the stars was worth investigating Before he knew it he had admitted to Hale that he had dreamed since boyhood of building the biggest of all telescopes Hale left the din ner with Yerkes check for $20 000 in his pocket to buy the Clark glasses and his promise of enough more money to make them into a forty inch lens In the end the financier contributed a total of $349 000 to complete the famous Yerkes Observa tory on the shore of Lake Geneva in Wisconsin

It was his father who had provided sympathy and help so many times that contributed another stride to his advance Even with the Yerkes Observa tory Hale realized that he needed an instru





THE GLASS GIANT OF PALOMAR How the 200-inch eye will be mounted under its huge shell taller than a fifteen story building atop a mountain a mile above the sea



Alum num walls and doors a e part of the system that controls the tempe ature under the b g dome

ment more pow erful than the forty inch tel *escope to make the study of stellar ev olution* effective His father saw this Quietly he wrote to a famous French glass maker and ordered the largest disk he could turn out. When it arrived, a great slab of clear green glass eight inches thick and sixty inches in diameter he presented it to his son.

That slab of glass became later on an important aid at the famous observatory at Mt. Wilson. It was the first of the modern reflecting giants which have culminated in the 200-inch instrument at Palomar The s xty inch telescope w ent into service in 1908 Already Hale was busy with plans for a 100 inch giant A campaign to have the Carnegie Insti tute of Washington D C establish a solar observatory on Mt. Wilson had succeeded and an old admirer of Hale s, John D Hooker had prom ised the money for a new giant of the sky a 100 inch reflecting telescope

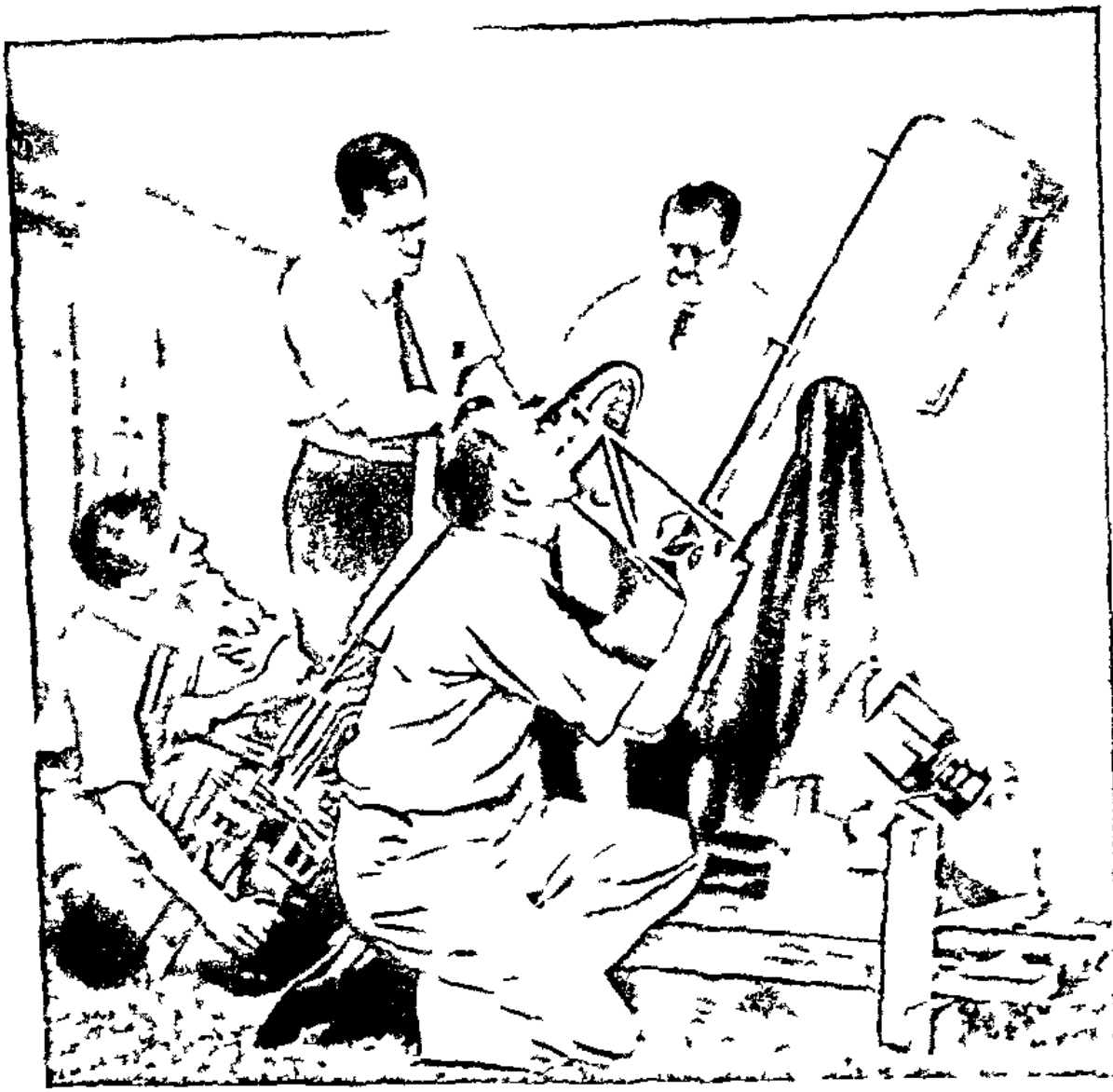
It was 1918 and the World War was drawing to a close when this huge astronomical eye made its debut It has remained for twenty years science s m ghtiest weapon in the attack upon the stars Men that Hale had trained—men at Mt Wilson at Yerkes even at his own private ob*servatory at Kenwood*—had carried on the details of solar study year after year

When the boundaries of the universe—as far as the 100 inch telescope would reveal them—had been explored, Hale now a man nearing six ty came to the conclusion that there was only one course to pursue More light A larger telescope still! Thus it was that his long dream reached its climax in plans for the glass giant of Palomar

How the Rockefeller Gen eral Education Board in New York City allotted the sum of $6 000 000 for the Palomar project how the great glass disk in the face of stagger ing difficulties was cast at Corning N Y how it was transported on special trains nursed through tunnels and down steep grades while crack flyers stood on the sid ings to let it pass how the mountaintop observatory took shape to re *ceive it—all this is recent history*

When Hale passed away on February 21 1938 he left behind three of the greatest observatories in the world—Yerkes Mt. Wil son and Palomar—as his monuments

It is curiously fitting that the last and greatest of these monuments the observa tory on Mt. Palomar was still incomplet when he died. Throughout his life new goals continually lay ahead Each achiev ment was succeeded by a new and greate one just as each of his larger telescopes car ried astronomical knowledge farther and farther into the abysses of the night sky



Not a new ant a rcraft weapon but an astronom cal camera for photograph ng myste ious "zod acal l ght

"SUN GUNNERS" USE ODD SOLAR CAMERA

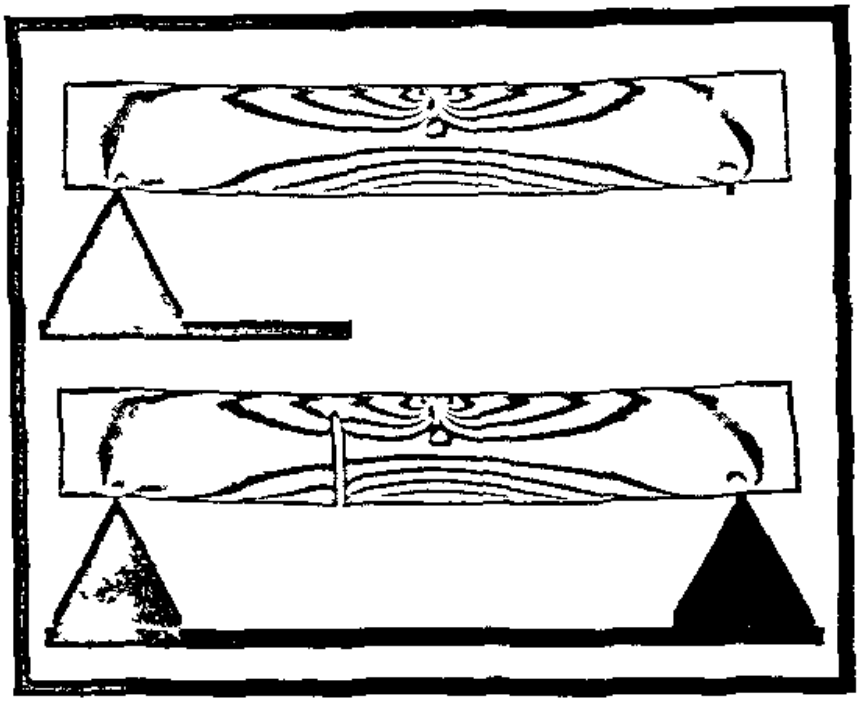
A SOLAR ecl pse had a new kind of photographic instrument trained on it last October when the apparatus shown above was set up in Brazil by Prof Charles H Smiley of Brown University Called a Schwarzchild camera it was designed especially to photograph the mysterious zodiacal light around the sun Ordinarily this faint illumination can be seen only at dawn or twilight extending upward from the horizon. Its source is generally believed to be reflected sunlight from a cloud of meteoric dust extending outward from the sun beyond the earth Hitherto astronomers had tried in vain to catch the mysterious light with cameras of ordinary types used in solar photography

Wanted: An Electric Storage Battery Without Lead

WARTIME shortages of lead and nickel in Germany have inspired an effort to develop an electric storage battery that is independent of these materials and the German Government has offered a prize of 10 000 Reichsmarks (about $4 000) for its invention It is pointed out that the development of a satisfactory leadless battery would not only make it possible to meet the requirements for gasoline powered machines but also enable electrically powered vehicles to be employed for many purposes

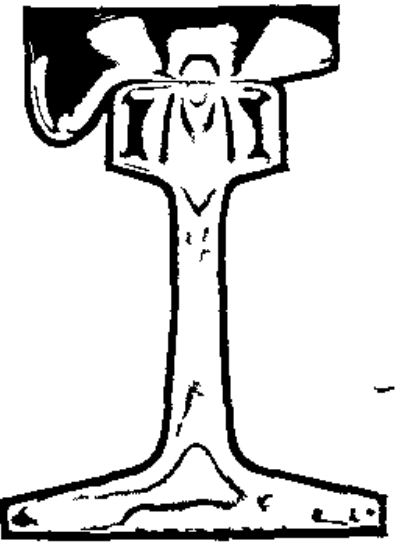
Polarized Light

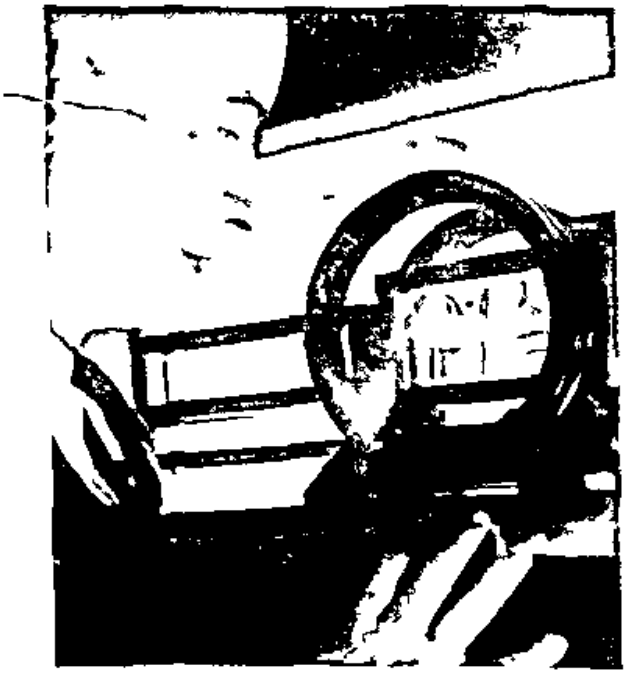
MAKES MACHINES SAFER



These photographs prove that after stress lines have been frozen in a sample by the new process even a saw cut will not change the pattern

Stresses set up when a railroad locomotive wheel delivers driving pressure on a rail are shown by the curved lines in the plastic model below as they appear by polarized light



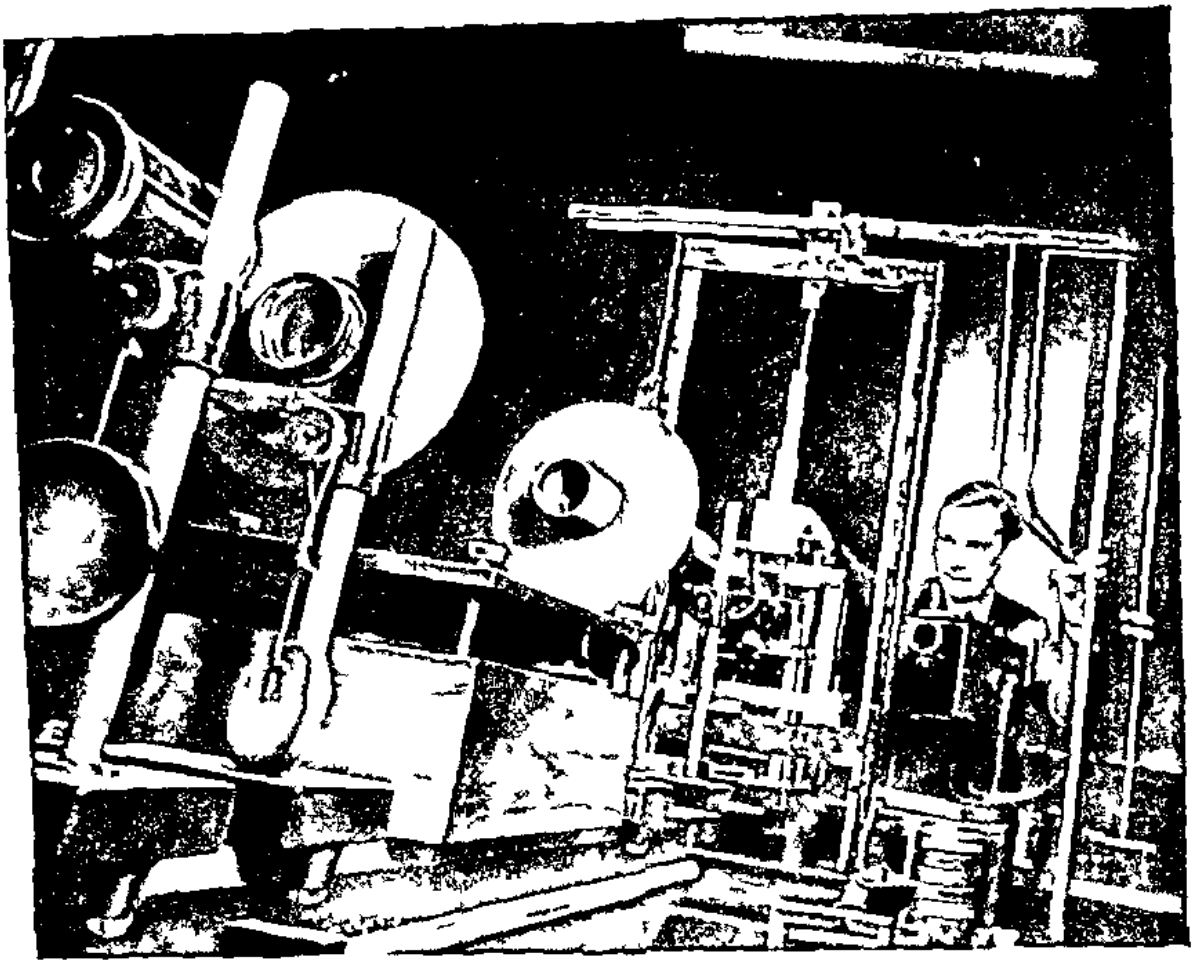


Racks like this hold "frozen stress" samples for observation in the novel tests. The two circular frames hold disks of a light polarizing material

THROUGH a new technique called "frozen stress," Westinghouse research workers can now look inside a piece of railroad track, a gear wheel, a crane hook or a spinning shaft, and see the danger points that might cause failure in service. Like earlier methods used by stress engineers, it applies a peculiar and beautiful phenomenon.

Viewed by polarized light, which vibrates in one plane, transparent models of machine parts exhibit rainbow patterns of color when subjected to internal stress as by bending or twisting. The various colors show the amount of strain much as contour lines indicate elevations on a map. This scheme has worked splendidly with flat and stationary objects.

Now the Westinghouse "frozen stress" method, for the first time, makes it possible to peer into various levels of deep, irregular objects by revealing the color fringes at each depth. In addition, it simplifies the problem of observing stresses due to centrifugal force in rotating parts, like the rapidly



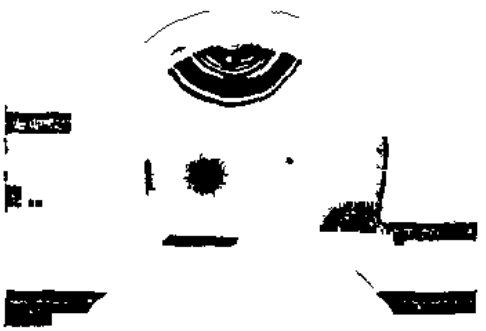
With this giant magic lantern Westinghouse engineers can look into a model operating under stra n

spinning rotor of a huge electric generator

Bakelite models placed in an electric oven are loaded to simulate actual conditions and cooked for an hour at 240 degrees F Part of the Bakelite a sort of infusible skeleton of cells remains solid and bends normally under the load The rest liquefies within the cells This fluid resin then solidifies as the oven cools to room temperature freezing the whole model in its stressed and deformed shape The model may be spun in the oven during heating and cooling with the same effect

The resulting test samples have the advantage of being permanent and easily handled requiring no further straining during examination Best of all they may be dissected like microscope specimens without disturbing the color fringe patterns Thus thin sections can be carefully sawed from the test sample at graduated levels and observed in order giving a complete three-dimensional picture of all stresses







Stress patterns frozen into a bakelite disk as it rotated at a high speed are revealed when it is inserted between the polarizing disks The photograph at the left shows the stress lines produced in a crane hook under load

WILLKIE OR ROOSEVELT?

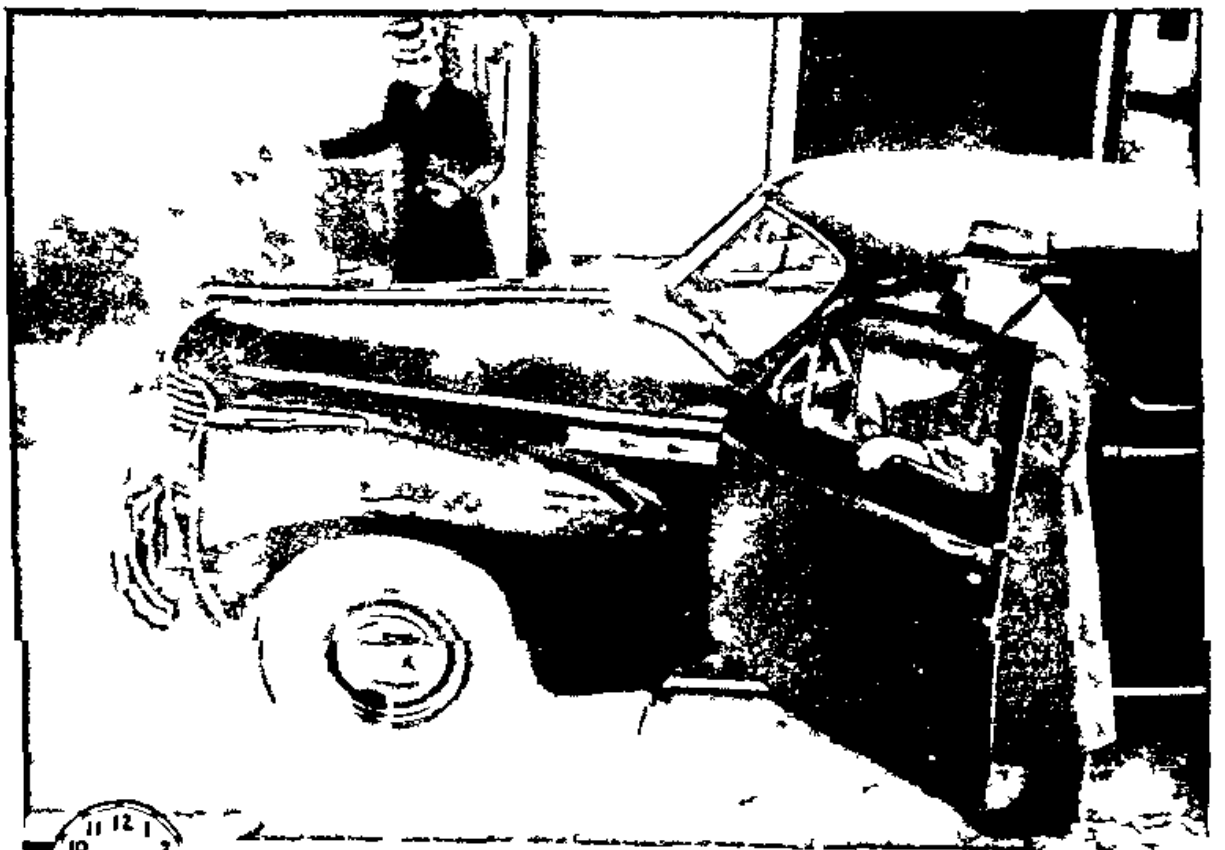
HOW SCIENCE SPEEDS THE COUNTING OF 40,000,000 VOTES

HUMMING over wires from every corner of the nation election returns in a few days will bring the answer to the question of America s 40 000 000 voters Who s elected?

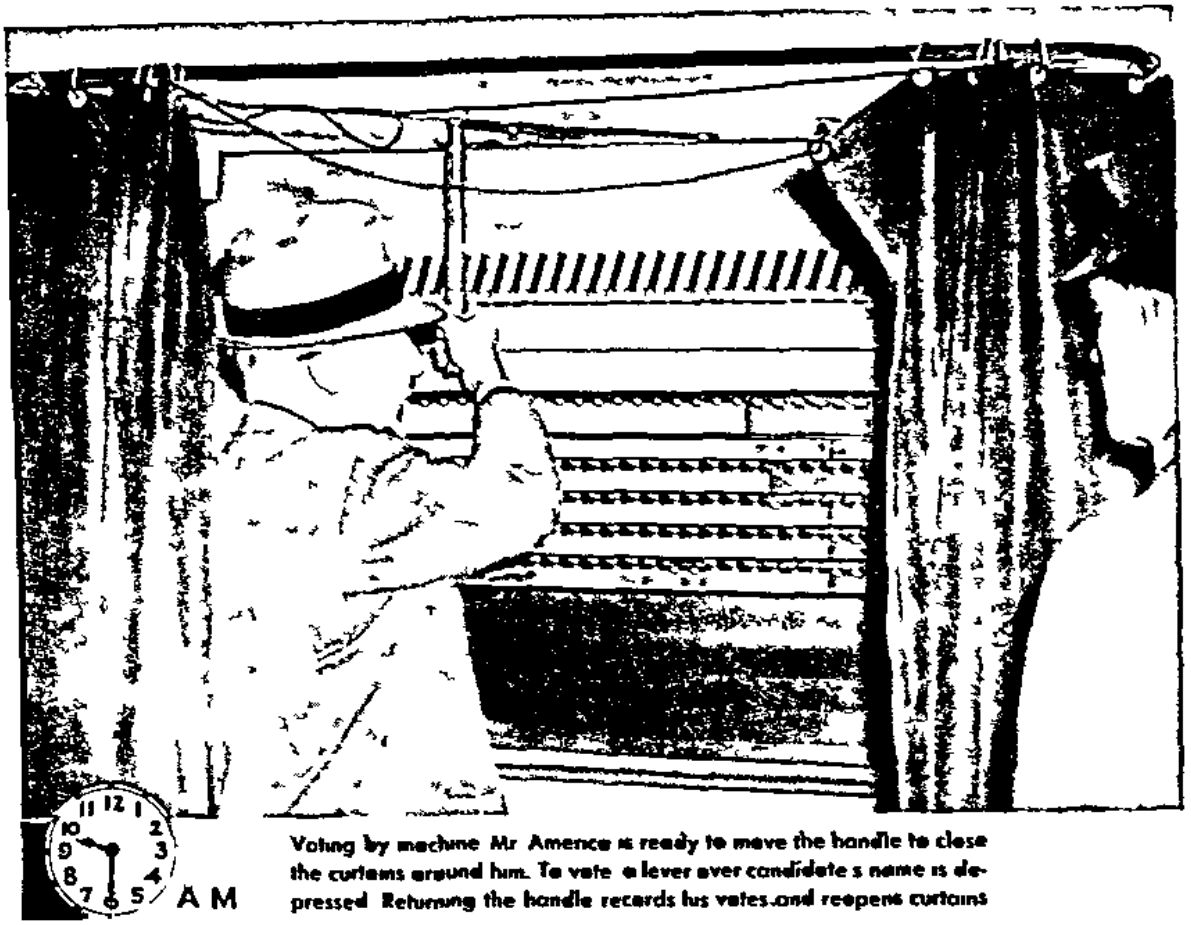
Years ago many days would pass before pos tive re sults of a Presidential election were known Today it is a matter of hours and minutes To make this possible a scientific network of communication machines—teletypes telephones telegraph and radio—manned by an army of workers has been recruited and promises the earl est election returns in history But nothing will aid the vote gatherers more than the voting machines that this year number 35 000 in twenty two states

First used around the turn of the century the voting machine by reason of its speed accuracy and honesty has come up in popularity until this year it will tabulate nearly a third of the votes cast.

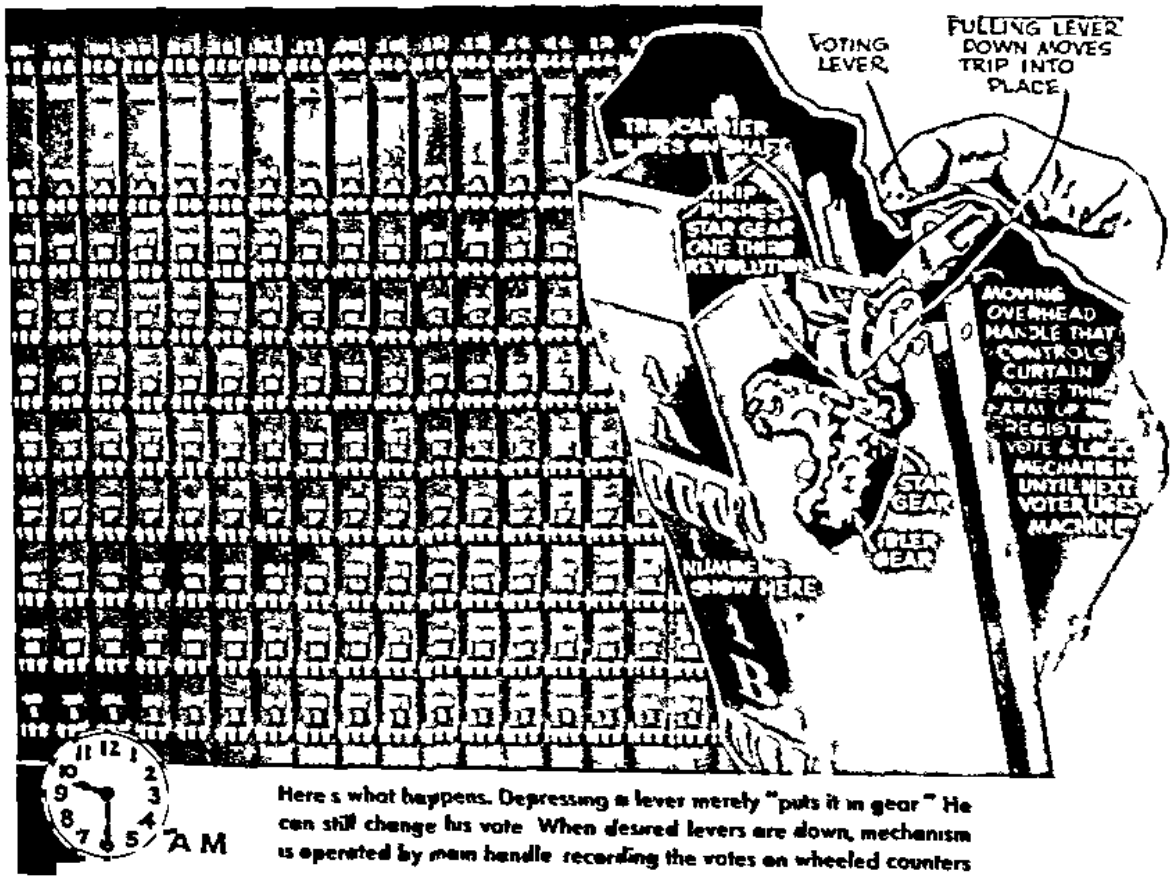
So you may see how modern high speed machines count the votes POPULAR SCIENCE selected a typ cal Mr and Mrs. America and in the series of pictures that follows starts you around the clock with them on Election Day and shows you how they may well know on the same night who s elected



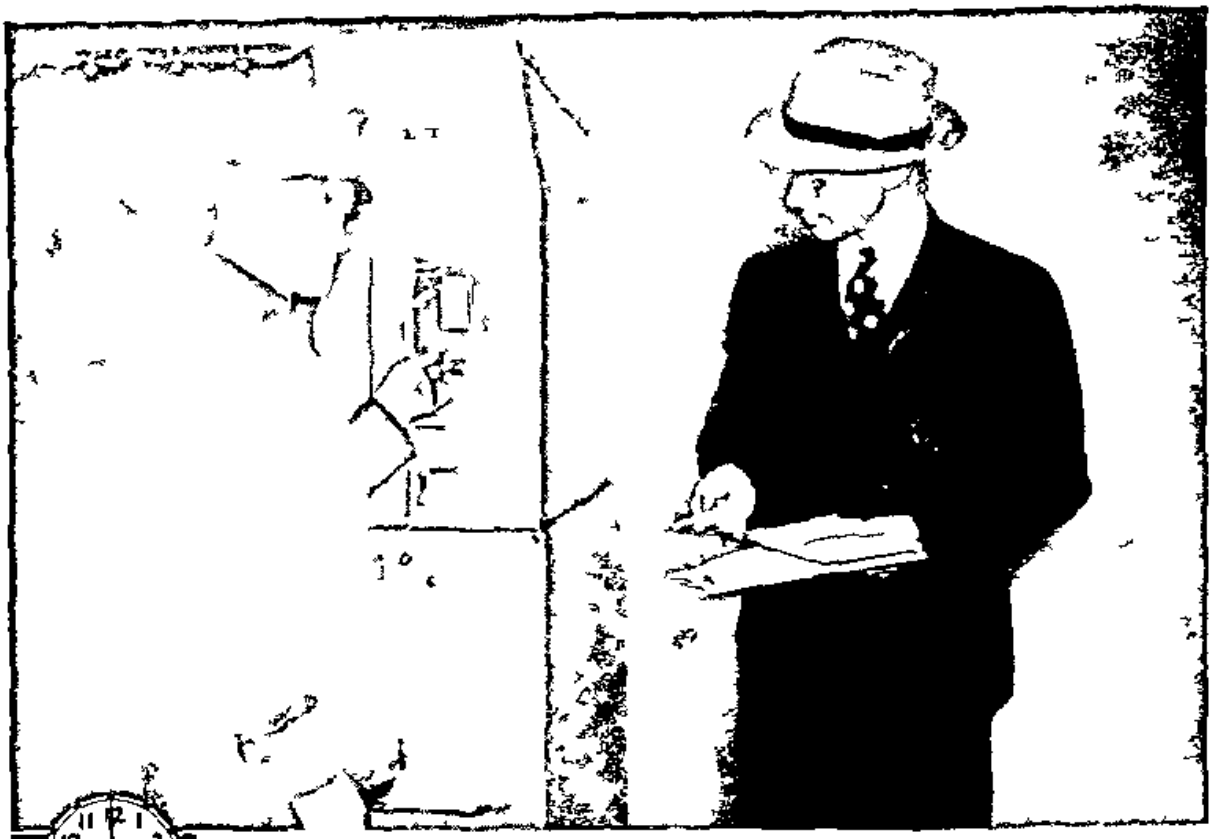
Mr and Mrs. America about to leave their home for the polls. They will "cast ballots" (Romans used to do it by "casting" tiny "balls" into an urn) for their candidates Most polls open at 6 or 7 A. M.



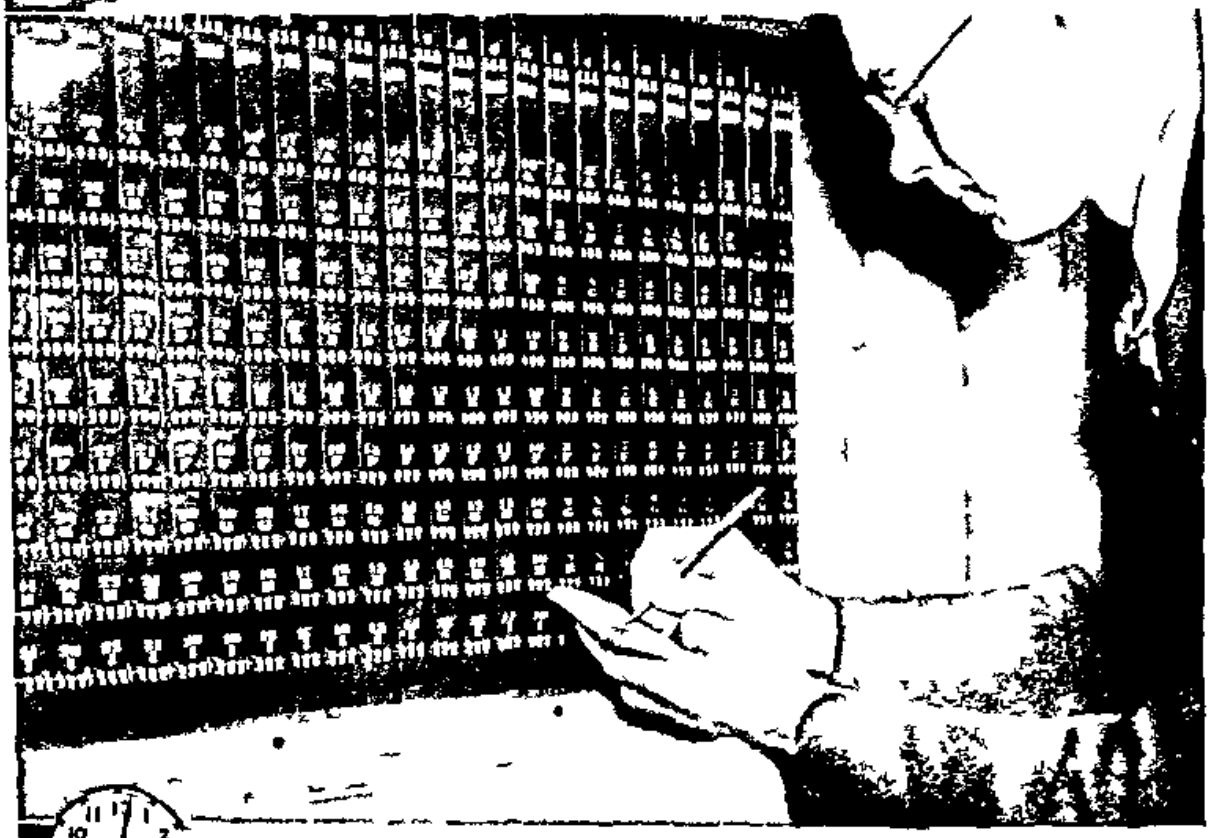
Voting by machine Mr America is ready to move the handle to close the curtains around him. To vote a lever over candidate's name is depressed. Returning the handle records his votes and reopens curtains



Here's what happens. Depressing a lever merely "puts it in gear." He can still change his vote. When desired levers are down, mechanism is operated by main handle recording the votes on wheeled counters



Twelve hours after opening the polls close Here an official locks the machine against further voting at the same time unlocking the hinged back revealing the rows of vote counters you see below



Each counter serves a candidate Copying recorded numbers is quick and easily verified later as a master key in possession of only the election board chief would be needed to alter the registered totals



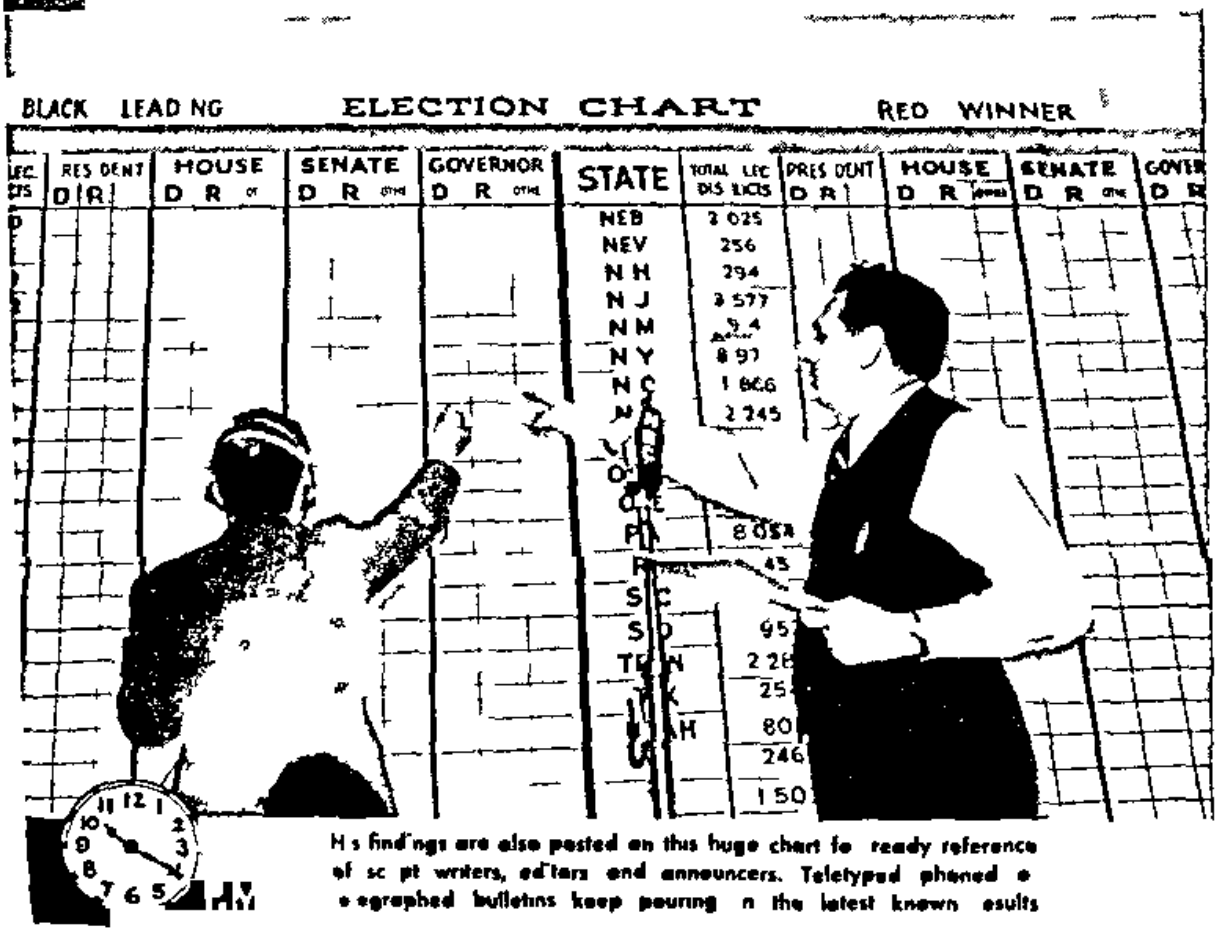
Pol'ce carry cop es of the returns from poll ng places to local pre cincts thence to headquarters Finally to the elect on boards for count ng Presently innumerable local and state returns a e totaled



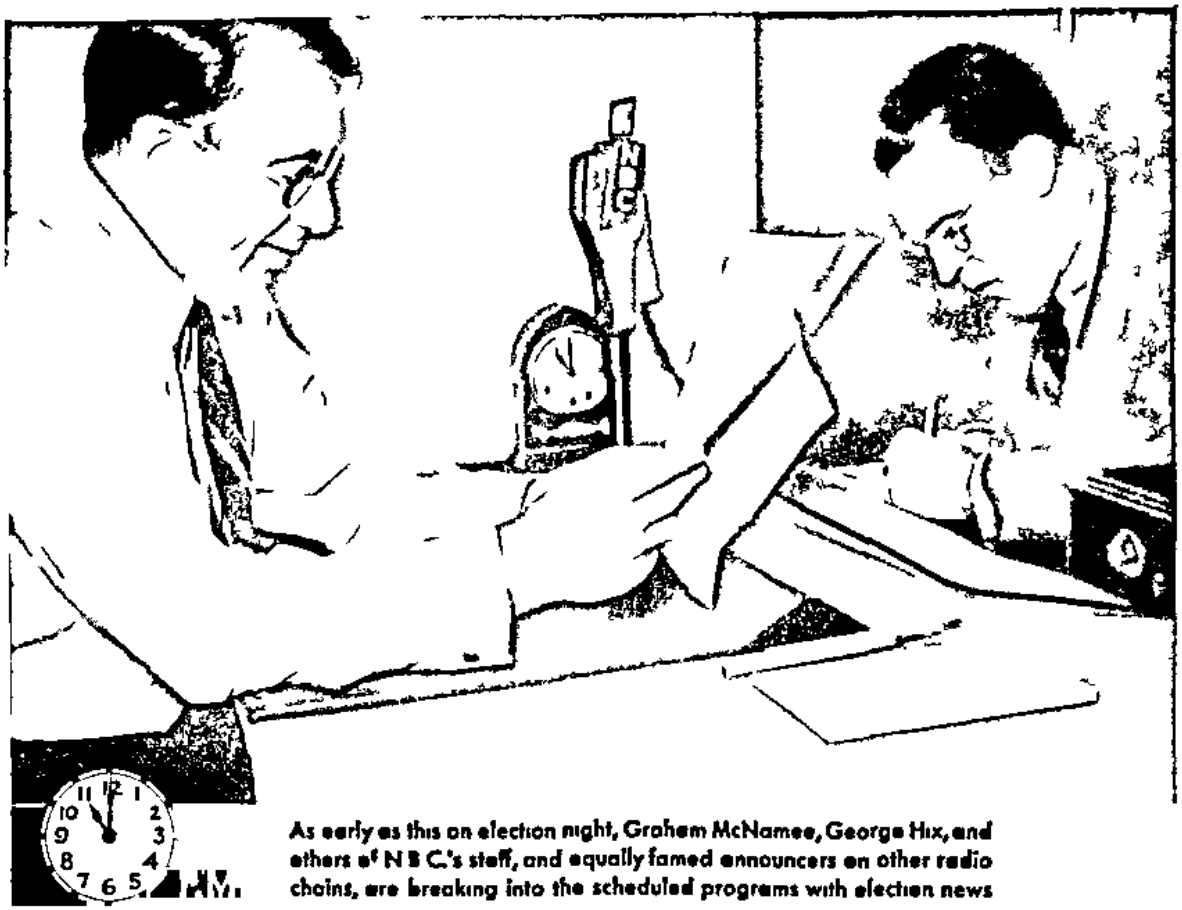
By now press associat ons beg n to rush early returns through the r teletype networks Here you see teletype rece vers record ng bulle t ns in the National Broadcast ng Company s New Yo k City news room



This statistician's work is an important step in the radio news room activities. He enters returns on a master chart adds them speedily and furnishes figures to editors who check scripts for the announcers



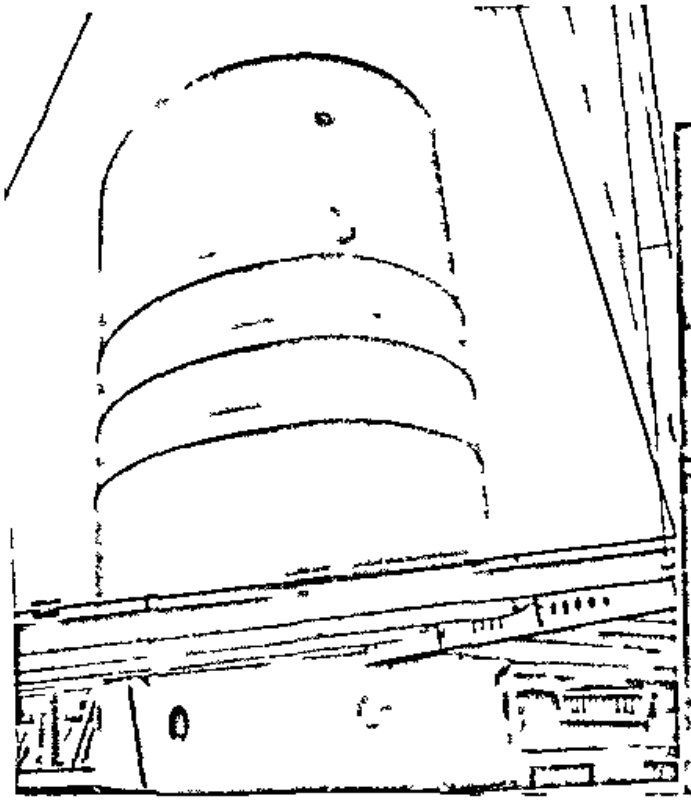
His findings are also posted on this huge chart for ready reference of script writers, editors and announcers. Teletyped phoned and telegraphed bulletins keep pouring in the latest known results



As early as this on election night, Graham McNamee, George Hix, and others of N B C.'s staff, and equally famed announcers on other radio chains, are breaking into the scheduled programs with election news



Just a few hours after the polls have closed Mr and Mrs America wa t tensely bes de their home radio They ll soon hear what they ve wanted to know for weeks and months Is it Roosevelt? Is it Willkie?

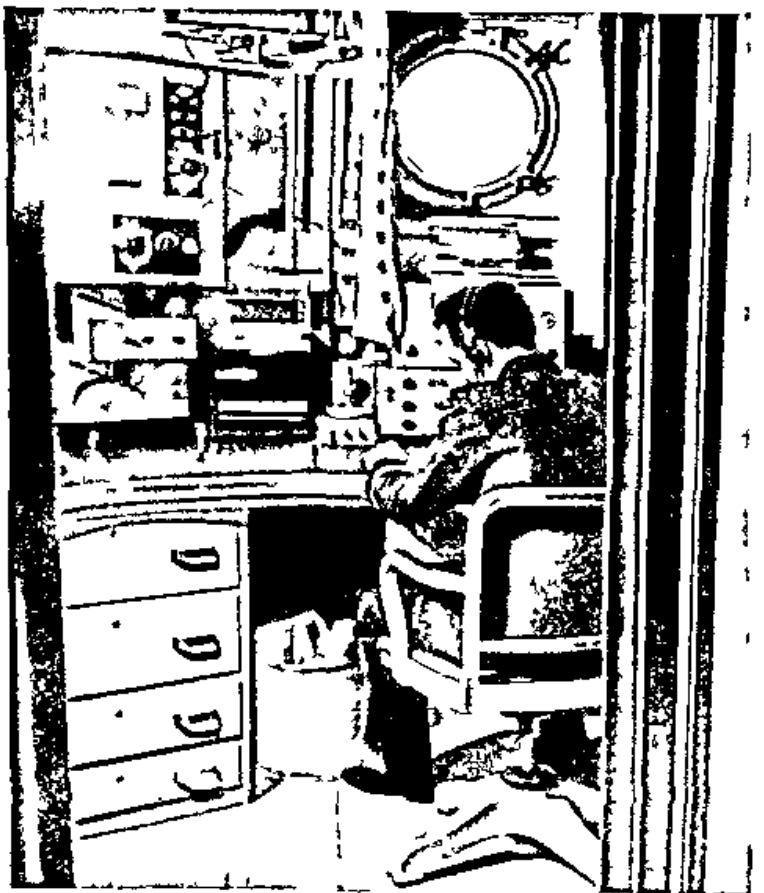


This passenger on the S S "Panama" is handing a radio message to the operator through a porthole in the ship's funnel. The dummy stack is pictured at the left



Liner's Radio Operator Works Inside the Smokestack

INSIDE the ship's smokestack is the unusual location of the radio room of the new American liner *Panama*. While the funnel, elliptical in section, measures seventeen by thirty-six feet, a twelve-inch pipe suffices to carry off the smoke of the engines. The remaining space in the dummy stack is divided into three levels, the first of which contains the completely equipped radio room, a comfortable stateroom, a storage room for deck-game equipment, and a spiral stairway that serves as a short cut to the captain's quarters below. On the second level, reached by means of a ladder, is a ventilator room housing engine exhaust blowers. Up another story is a room where the ship's whistle may be reached for adjustment or repairs. Portholes admit fresh air to the rooms within the funnel, which are reached through a door that is curved to conform to the exterior contour. In the photograph at the right, the *Panama's* "Sparks" is seen in his unusual quarters.



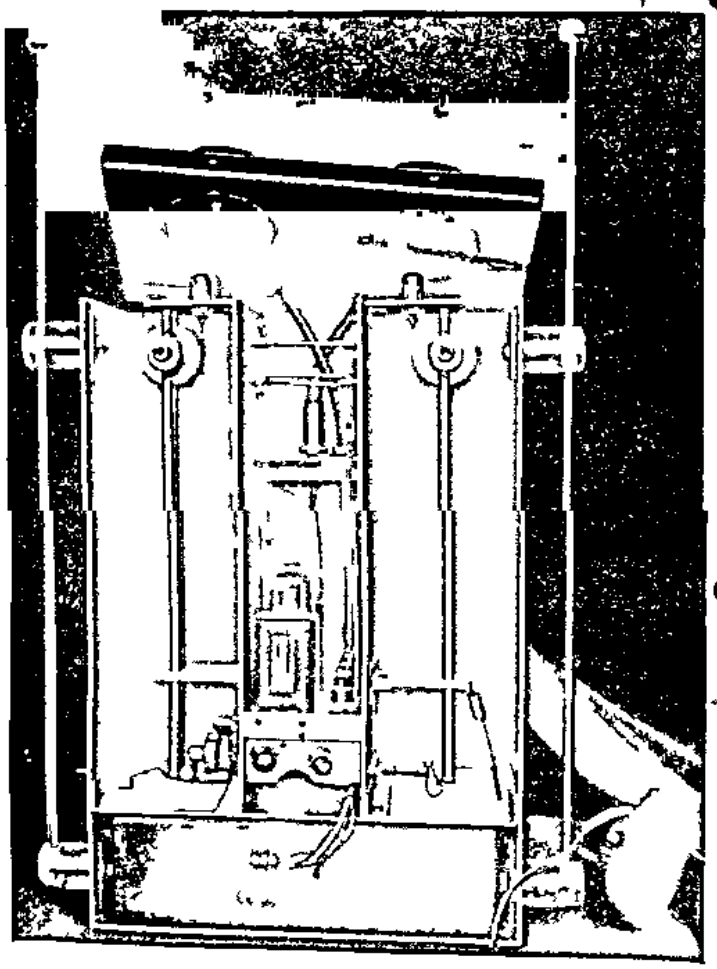
Interior of the unusual radio room. The funnel also contains a stateroom, a storage room for deck games, and the ship's whistle

Two-Way Firemen's Radio Is Carried on the Back

AS A result of months of research work by two New York firemen Samuel Harmatuk and Arthur Meyerson smoke eaters in America s largest city soon will be directed in fire fighting and life saving by means of lightweight, back pack radios Weighing only fifteen pounds the two way units can be slipped on over heavy fire fighting clothing leaving the hands free for climbing A flexible cable controls the switch which shifts the set from transmitting to receiving and back again The microphone is located on one of the shoulder straps of the harness and the earphones, of soft rubber can be worn under a helmet Telescoping antennas are located on either side of the waterproof case which houses the set Power for the unit is supplied by dry-cell batteries with a life of seventy hours The specially designed condensers are not affected by heat During tests recently conducted by the New York Fire Department the sets proved they had a range of as much as a mile In use they will enable a fire chief to talk to smoke eaters at work inside a burning building



Fireman wearing back pack radio. Note the microphone and switch cable attached to harness straps



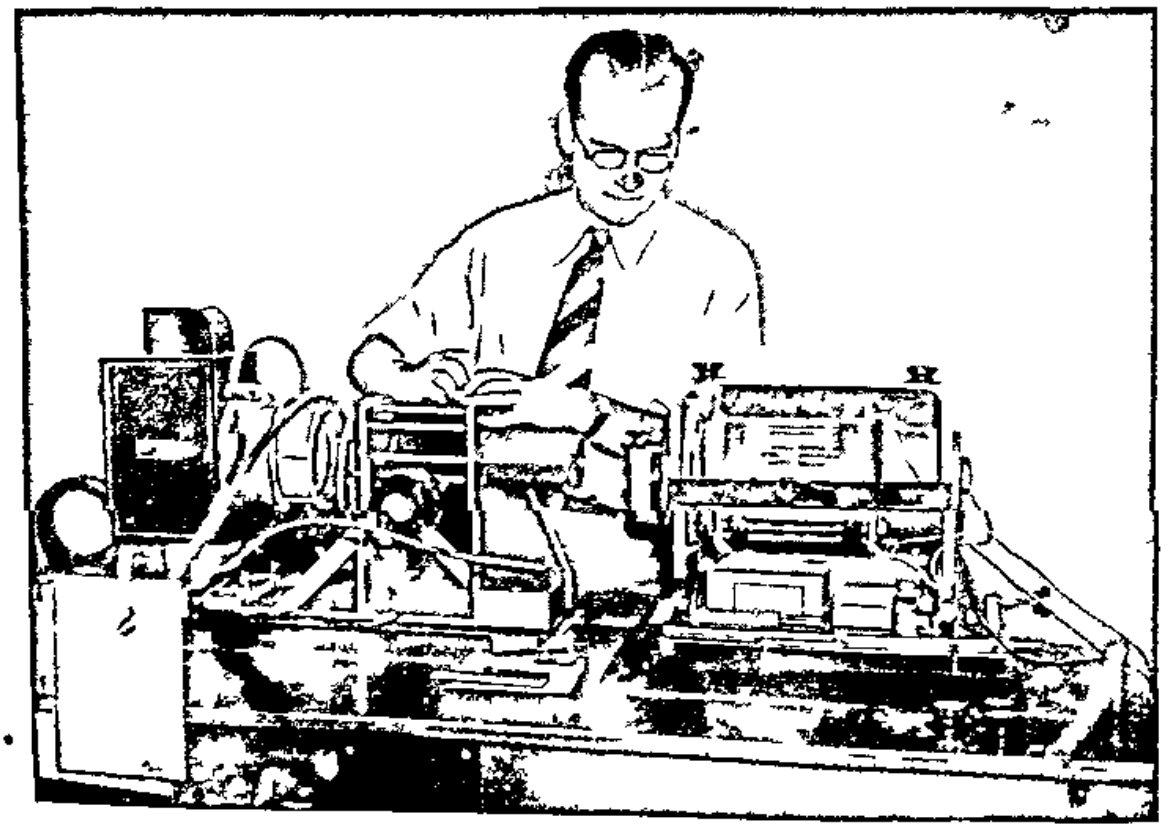
Weighing only fifteen pounds the two way unit uses a regenerative circuit and is powered by dry cell batteries good for seventy hours

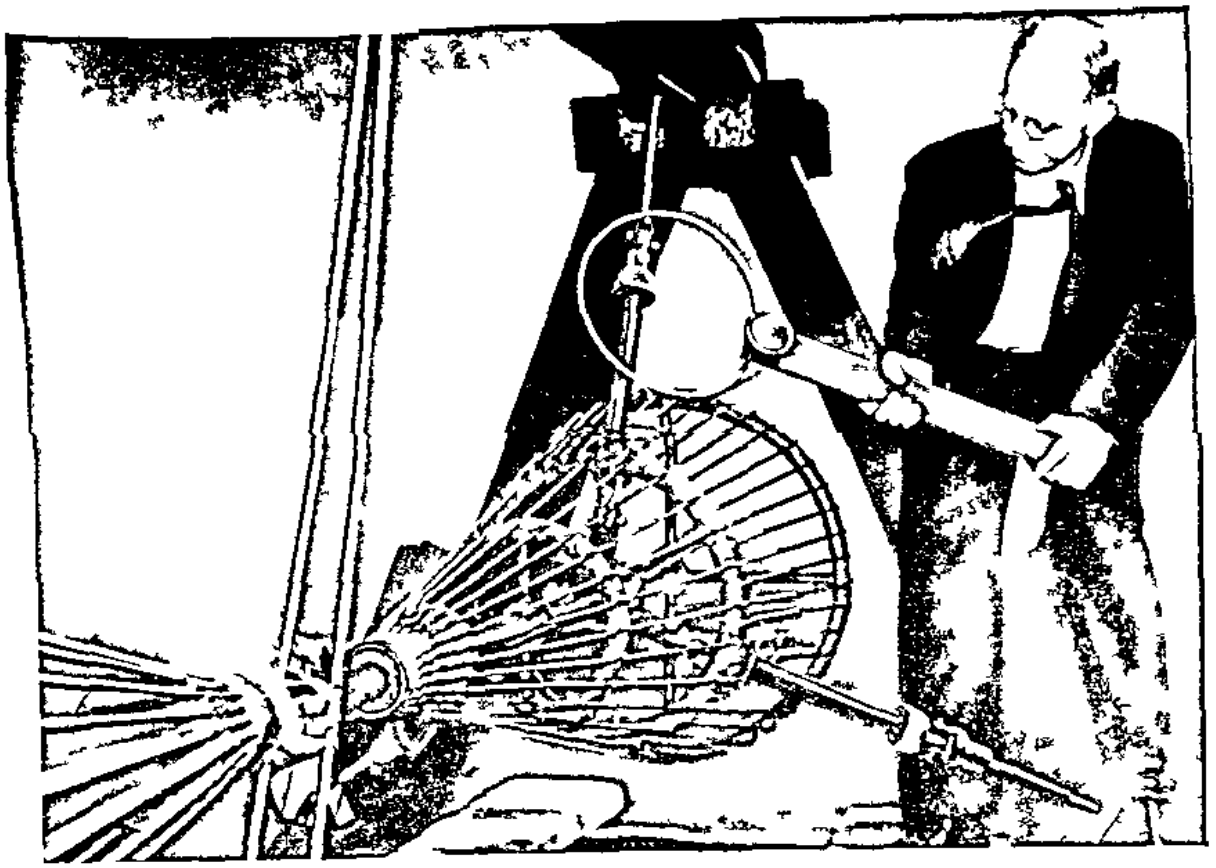
New Television System Transmits Images in Full Color

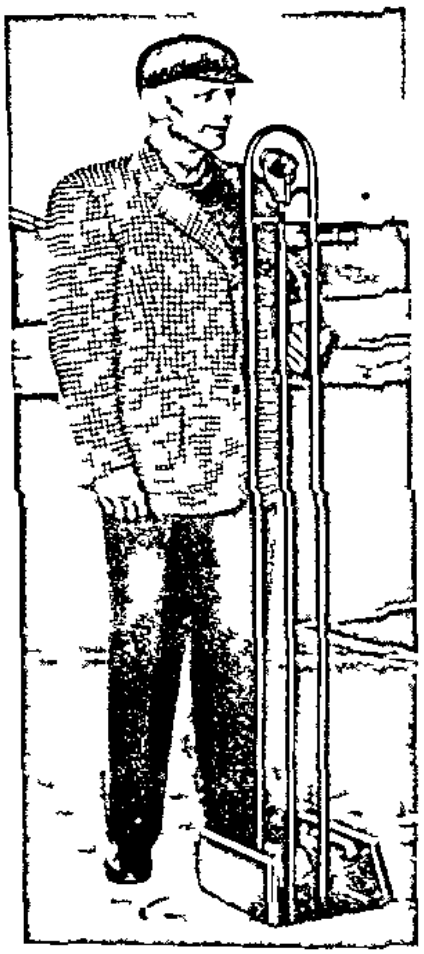


NATURAL-COLOR television long in the experimental stage may soon be on the air A new process devised by Dr Peter C Goldmark of New York and recently demonstrated by the Columbia Broadcasting System transmits color movies successfully The next step will be to adapt it to broadcasts of living subjects At the transmitter the image is scanned alternately on odd and even numbered lines Rotating color filters give the sequence of red green blue red green blue Thus two full color cycles serve for three pictures This allows time for high definition scanning of 343 lines or more Viewed through synchronized filters at the receiver the pictures all appear in natural color since the eye retains one color image just long enough to blend it with the next two When no color filters are used with the receiver the image is black and white

Television transmitter scanning colored movies Below is the receiving end of the novel system







Basket-Shape Television Antenna Gets Broadcast-Power Tests

ASSUMING the stance of a butterfly collector about to pounce on h s prey the eng neer atop the rad o tower above is up to more serious bus ness H s r ng shaped implement measures the strength of rad o waves and the even queerer looking object in front of h m is the latest in television antennas By holding the ring in various pos t ons and read ng a meter on its handle he is testing the amount of power that the cagel ke aerial radiates in different directions Just perfected by General Electric engineers this conical antenna has been erected at one of the company s stat ons near Schenectady N Y where it will be used for future p cture broadcasts The photograph also illustrates how a good television s te commands a view of the horizon

Eavesdropping Mike Listens In on Umpire's Scraps at Ball Park

SO THAT baseball fans may eavesdrop on arguments between the ump re and players next spring a disap pearing microphone has been included in a new publ c address system at a Wichita Kans stad um Pressing a foot lever allows the m crophone to pop from its underground box near the home plate Through loudspeakers the spectators then enjoy the novelty of hearing what is going on In case a dispute becomes too heated for sens tive ears the mike hastily retreats As at left it may also be used for announcements

Torture Machines



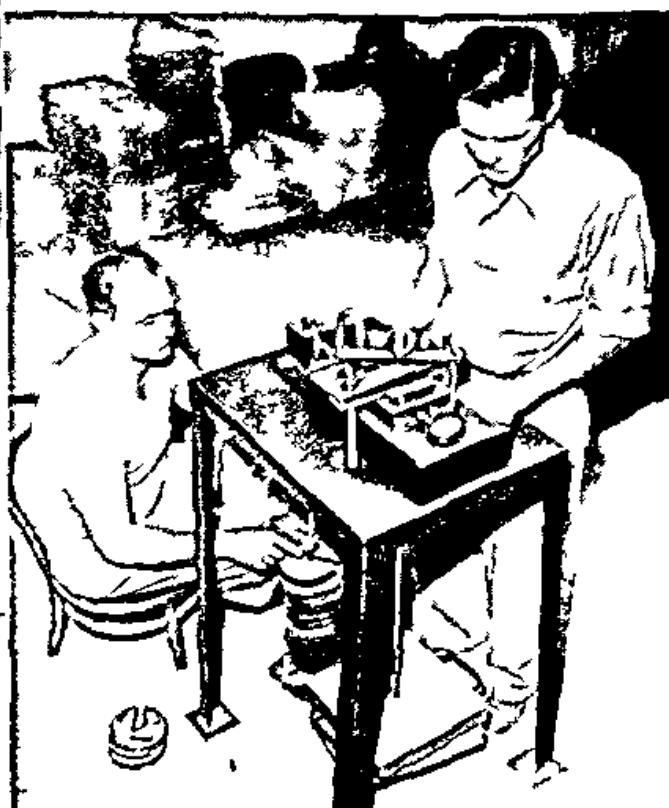
A battery of permeameters, instruments that show how much water will seep through a given material

WALK along the crest of one of the many earth dams built by U S Army engineers throughout the nation and you may wonder how grains of sand and silt and rocks can hold back flood waters The answer is that every layer is subjected to a battery of torture tests by unusual machines which extract the innermost secrets of soils

Testing devices perfected in the Los Angeles Calif district drip water through various dam building materials compress others until they no longer can be squeezed smaller and shear tightly packed specimens until they split

To small samples of soil devices called consolidometers which resemble large machine guns in firing position apply pressure equal to that anticipated in the dam structure As the thickness diminishes micrometers indicate the change within a thousandth of an inch Some of these machines apply loads up to twenty eight tons to the square foot more than would be exerted at the base of Mud Mountain Dam an earth structure which rises 400 feet above the White River in Washington The results show how much the materials will settle under various loads

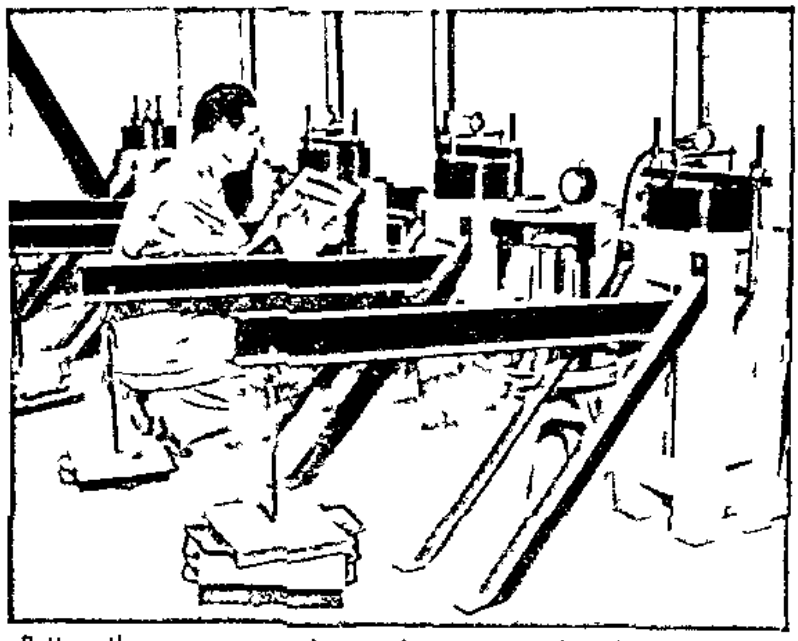
Will the foundation of a dam move under pressure? In the device below samples of soil are tested for resistance to shearing



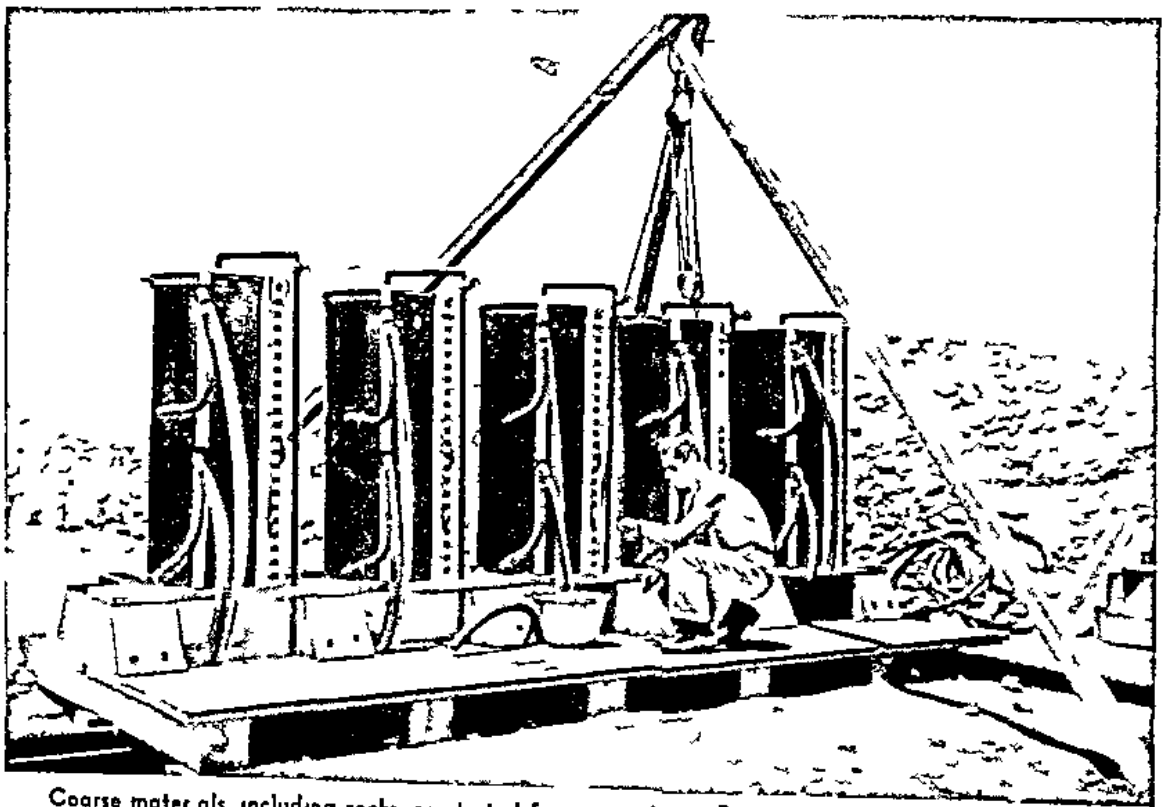
Test Soil for Big Dams

Permeameters receive samples whose density and weight have been recorded These devices consist simply of tubes into which soil samples are placed and containers permitting water to ooze through the samples By this means the engineers determine both the density required for various materials and the various parts of the dam to which they will be allocated Larger permeameters in the field take coarser materials including six inch rocks

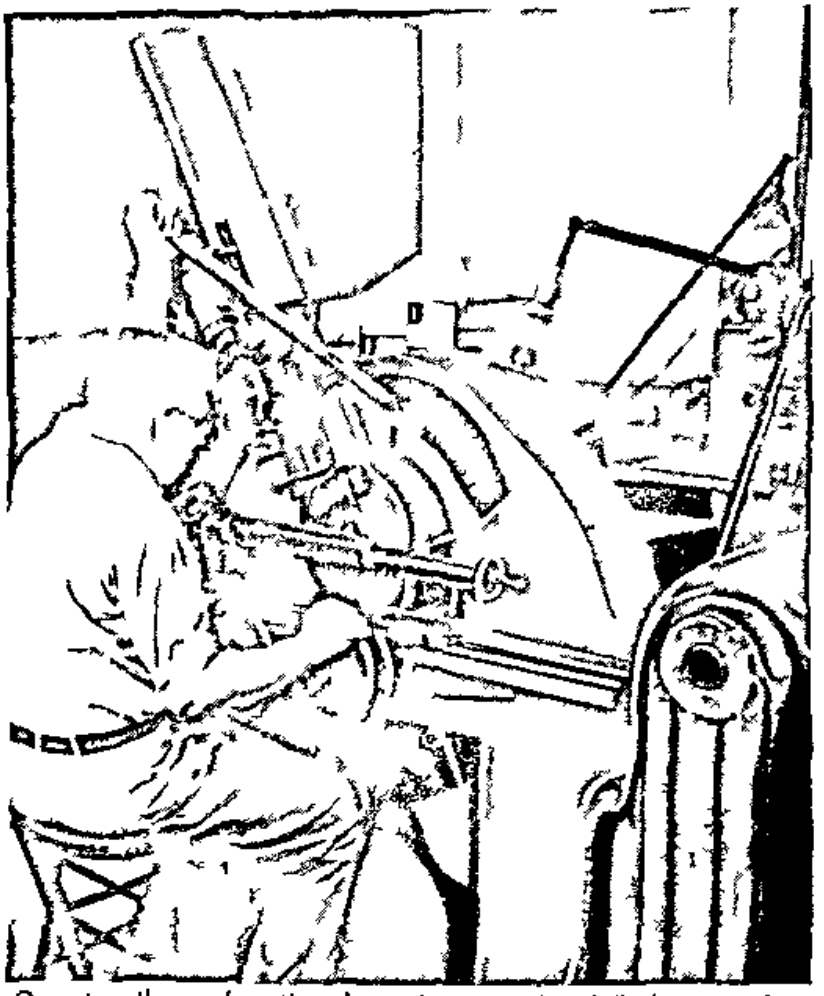
To determine whether foundation materials underlying the huge structures will move under pressure compacted samples are submitted to powerful shear machines Each double handful of soil is packed tightly in a double box For several days pressure equal to that sustained in the field is applied Then the upper half of the box is elevated a sixteenth of an inch, and slowly while one hydraulic jack maintains tremendous vertical pressure another shoves sideways until the sample splits in half as instruments register the forces required



Putting the squeeze on soils samples compressed in these machines reveal the extent to which a dam foundation will settle under load



Coarse materials including rocks are tested for permeability in the field in large tanks like these



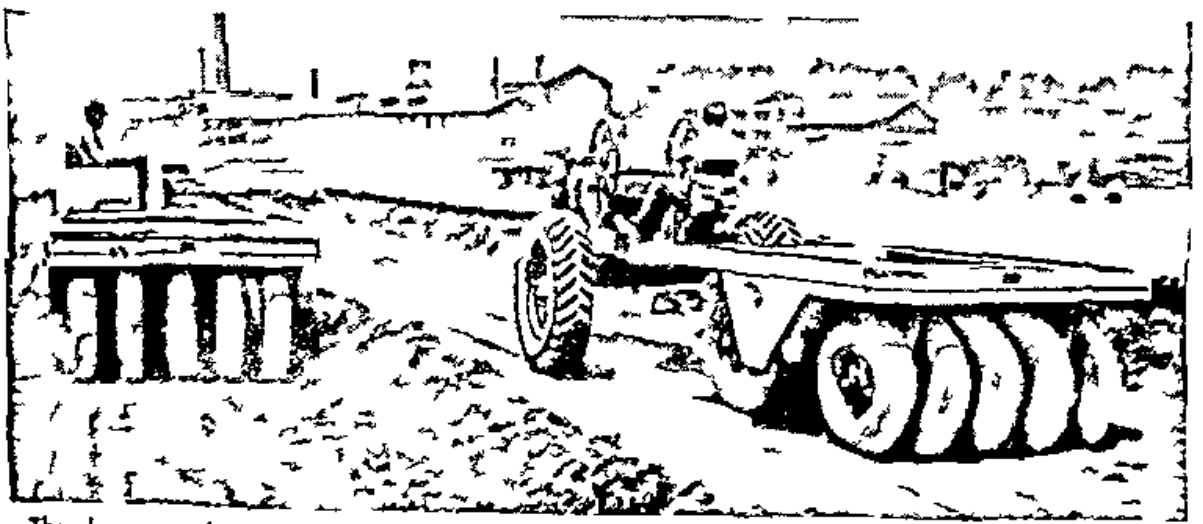
Ope at ng the mach ne that shapes bassoons then d lls the tone holes

Odd Machine Makes First U. S. Bassoons

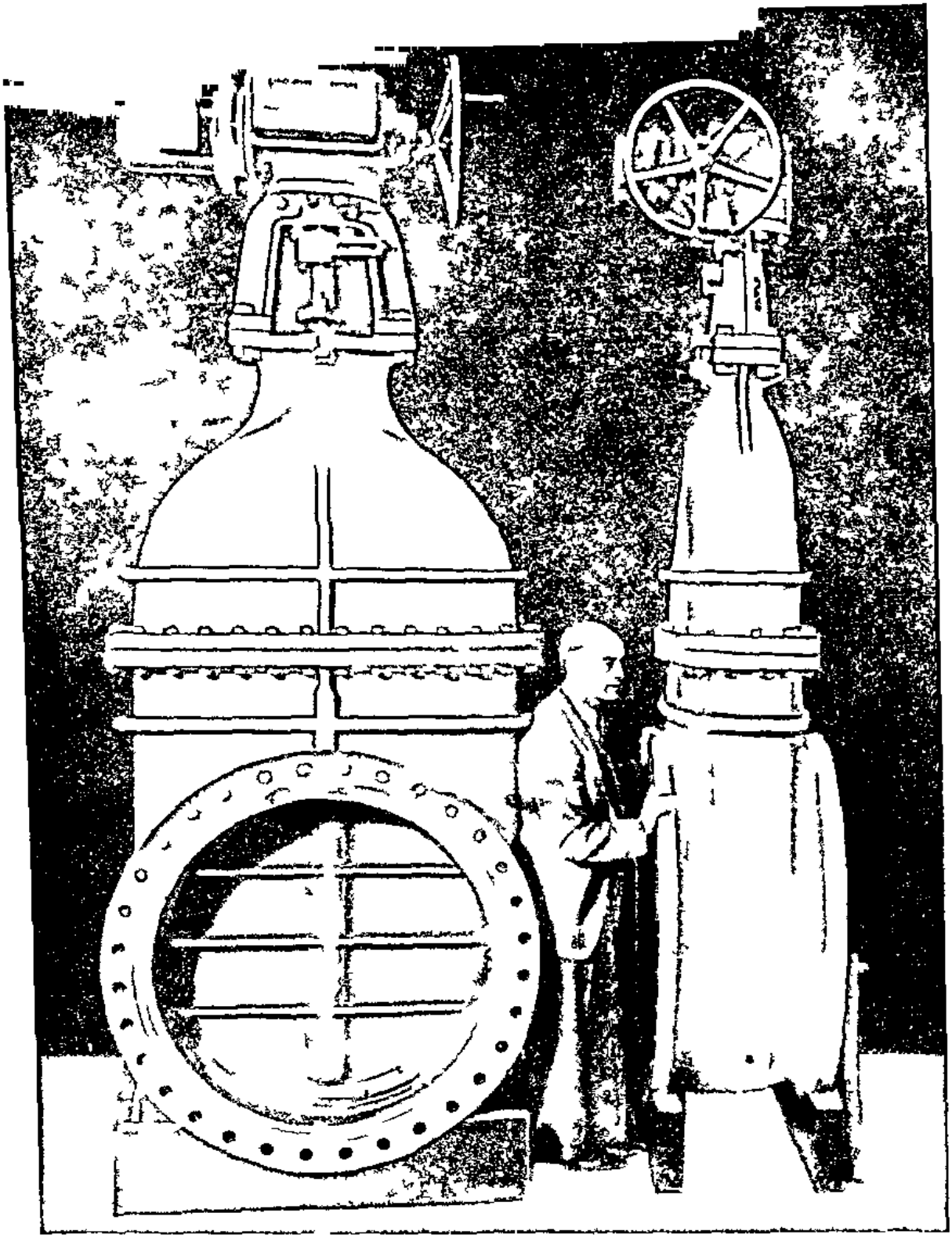
PRODUCED by the ne cess ties of war that has cut off the foreign supply of musical in struments the first ma chine made in America for turning out bas soons recently began funct oning in an Elk hart, Ind factory In prewar days these in struments were im ported from Europe Because the body has to be turned out with an oval shape and the tone holes must be drilled into the body at differ ent angles these in struments are hard to produce The Ind ana machine a combined lathe and drilling ap paratus speed ly turns out the body of the in strument and then drills the holes as required.

Rubber Tires Replace Iron Rollers To Pack Road Soil

BATTERIES of close set rubber tires are now replacing clank ng ponderous iron rollers in packing down the so l for new highways The specially des gned tires with smooth treads are placed s de by side in two series one just ahead of the other Their treads are staggered so they cover all the ground in a g ven strip Nine of the t res five behind and four in front, support the weighted framework of the novel roller



The clo e spaced g unt t es heav ly we ghted a e sa d to pack so l mo e effect vely than on rolle s



Giant Valves Made for Biggest American-Built Liner

WEIGHING more than 5 000 pounds ap ece four giant valves tw ce as tall as a man were spec ally constructed for use on the *America* the largest passenger l ner ever bu lt in th s country Installed in the circu lating condenser l nes of the vessel the valves have an open ng th rty six inches in d ameter Sol d wedge type bronze d sks weighing 1 000 pounds apiece close the openings when the valves are shut Moto operated the valves are the largest ever ordered for the American merchant marine

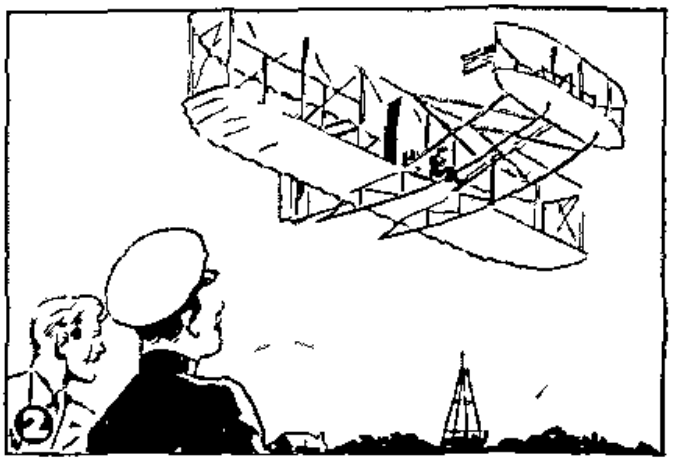


Here's My Story

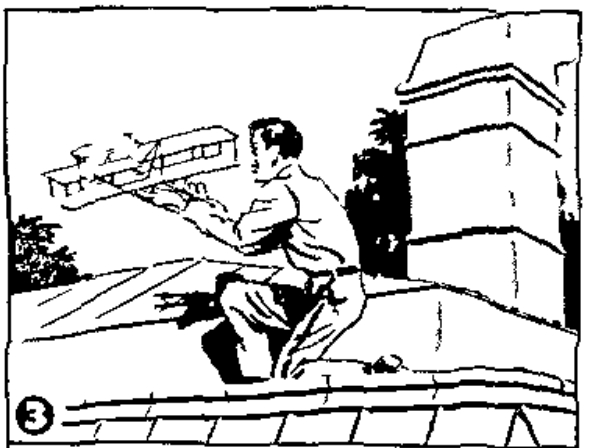
DONALD WILLS DOUGLAS WAS BORN IN BROOKLYN N.Y., APRIL 6 1892



AT 17 IN 1909 HE ENTERED THE U S NAVAL ACADEMY AT ANNAPOLIS



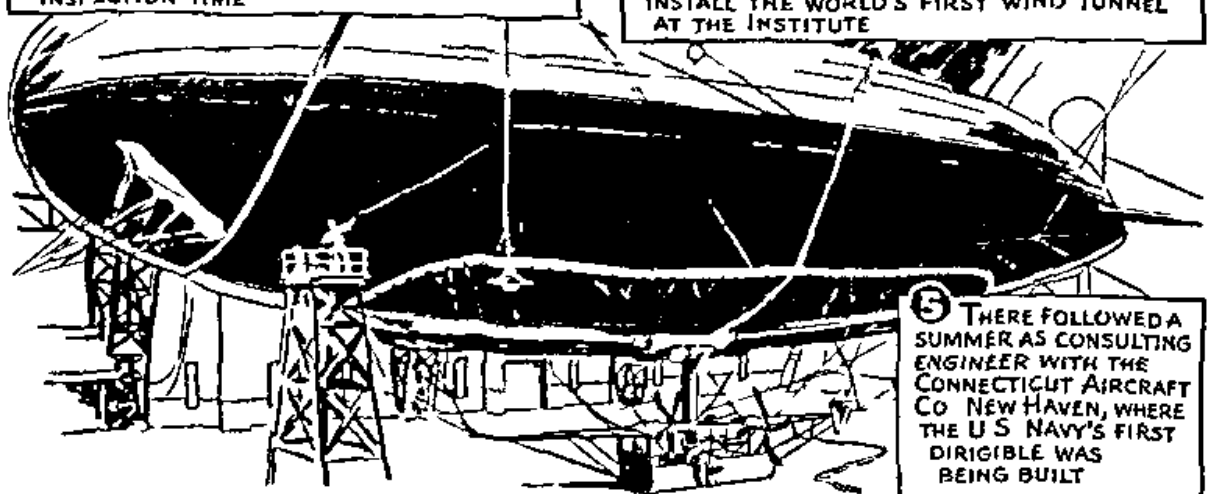
THE SAME YEAR WHEN ORVILLE WRIGHT FLEW THE ARMY'S FIRST BIPLANE IN ACCEPTANCE TESTS AT FORT MYER VA, YOUNG DOUGLAS PRIED OPEN HIS SAVINGS BANK TO GET MONEY TO GO AND SEE HIM



AFTER THAT HE READ EVERYTHING HE COULD LAY HIS HANDS ON ABOUT AVIATION BUILDING MODELS HE FLEW THEM FROM THE DORMITORY ROOF—HID THEM AT INSPECTION TIME



TRANSFERRING TO THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY TO STUDY AERONAUTICS, HE GRADUATED IN 1914 HIS FIRST JOB—AT $500 A YEAR—WAS TO HELP INSTALL THE WORLD'S FIRST WIND TUNNEL AT THE INSTITUTE



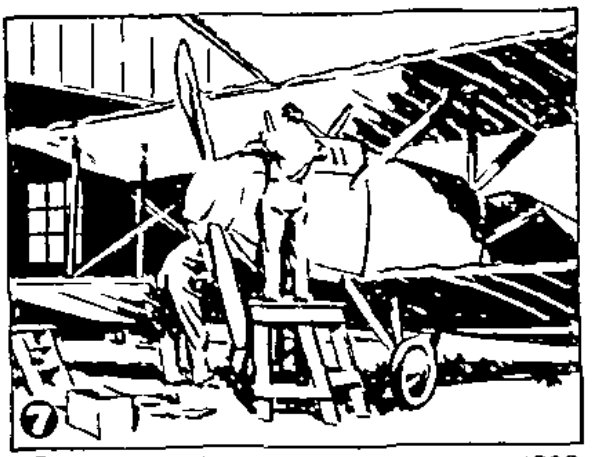
5 THERE FOLLOWED A SUMMER AS CONSULTING *ENGINEER* WITH THE CONNECTICUT AIRCRAFT CO NEW HAVEN, WHERE THE U S NAVY'S FIRST DIRIGIBLE WAS BEING BUILT

THE CAREER OF DONALD W. DOUGLAS

DOUGLAS — FIRST AROUND THE WORLD



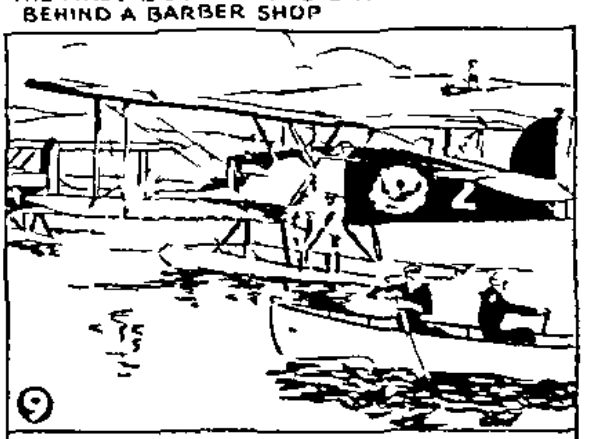
In 1915 Douglas went to the Glenn L Martin plant in California as chief engineer after the company had moved to Cleveland Ohio he designed the first of the famous Martin bombers



Backed by a Hollywood sportsman, in 1920 he built the "Cloudster — first plane to lift a useful load equal to its own dead weight The first Douglas factory was a room behind a barber shop



Armed with blueprints for a torpedo plane he invaded Washington, D C., a little later and landed a $120 000 Navy contract for three of the craft



In 1924, U S Army flyers carried the fame of Douglas military planes around the world, making the first circuit of the globe in Douglas ships with Liberty motors



All metal Douglas transports appeared in 1932 and soon were carrying passengers an average of 350 000 miles a day in the U S and 22 foreign countries Douglas has won the highest honors in aviation, the Collier Trophy and the Guggenheim Gold Medal Today his California factories employ 17,000 workers



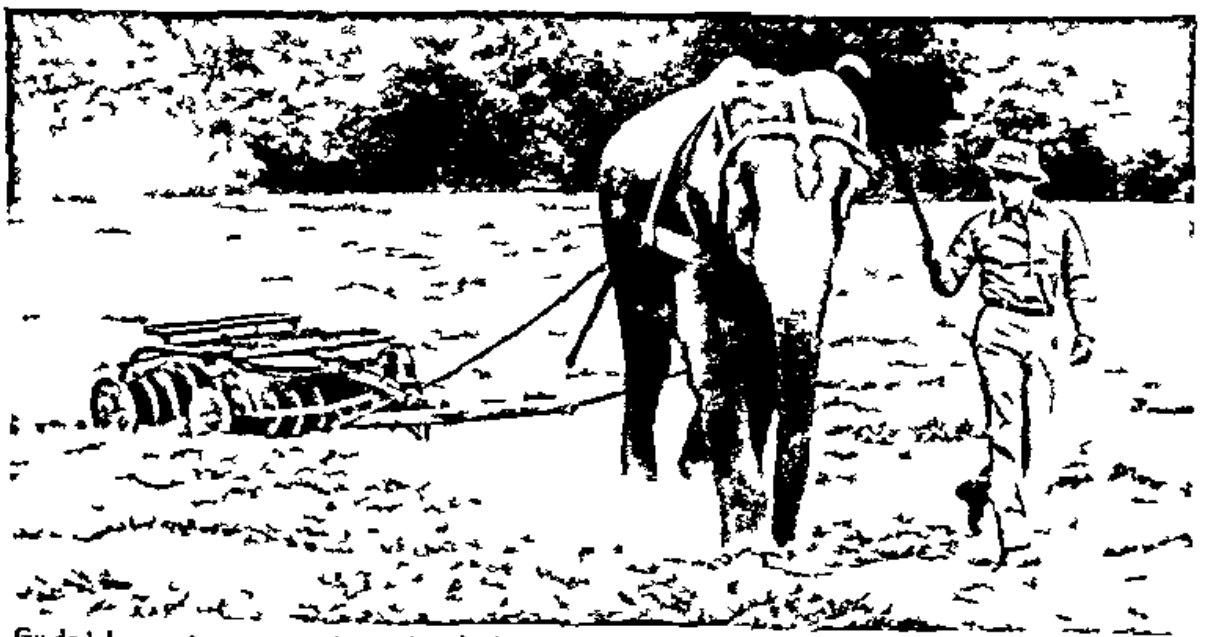
A cs t aced by f'xed l ghts show v b at on of George Wash ngton B dge

Night Picture Catches Bridge Doing a Shimmy

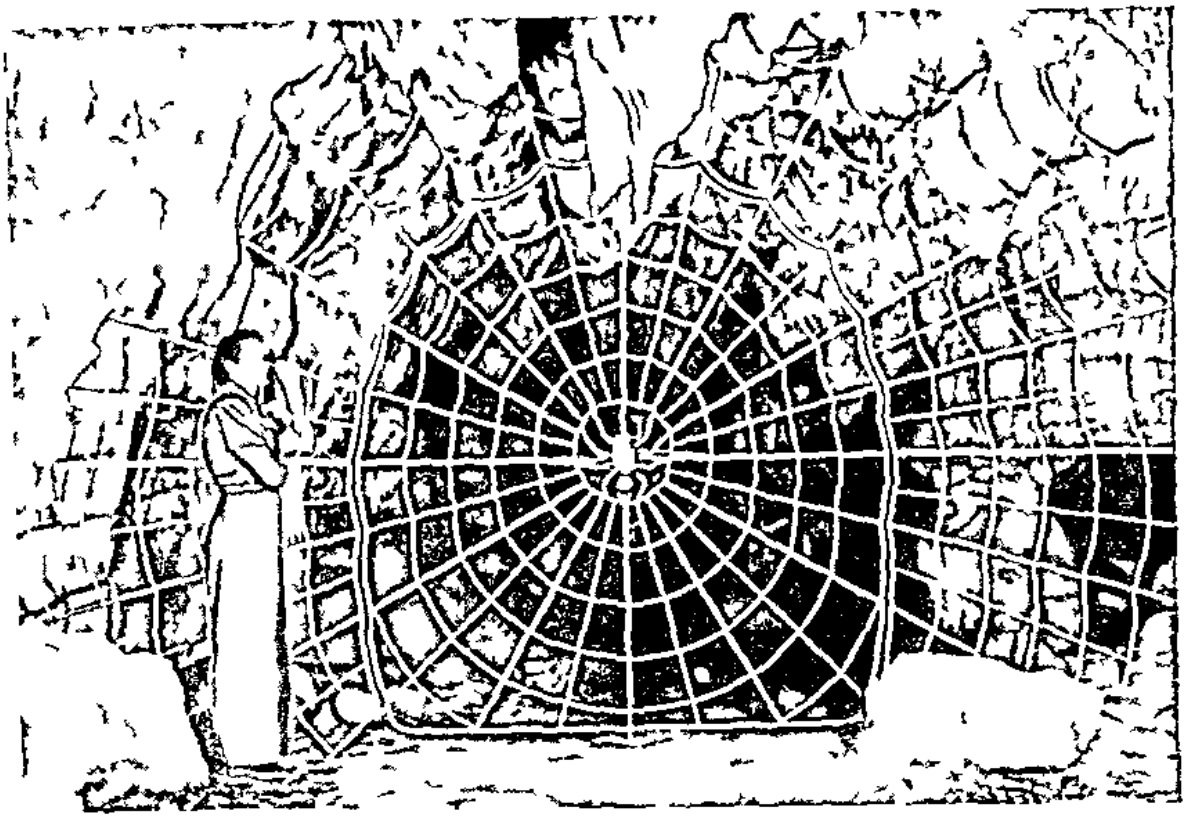
How a big suspension bridge shimmies under passing traffic has been demonstrated photograph ically by Lilo Maier New York camerawoman *Steadying the camera on* a hand rail of the George Washington Bridge and pointing it toward the ap proaches she made the fifteen second time expo sure at the left Disregard ing luminous streaks made by headlamps of moving automobiles she points out that all fixed lights show up as short, vertical arcs wh ch reveal the vibrat on *of the bridge more graph* ically than any engineer ing formula Anyone can duplicate the experiment with the simplest of cam eras by properly adjusting the exposure time

West Is East as Elephant Plows South Carolina Field

It MIGHT be a scene in a far away India but the picture below was taken near Cam *den S C The elephant s* name *is Alice* and she s pulling a disk harrow on the plan tation of Matthew Ferguson sportsman. Though neighbors are said to be nervous about the poss bility of *Alice* going on a rampage she seems qu te peaceful



Gu ded by an Ame can mahout the elephant Al ce pat ently drags a har ow on a southern plantat on

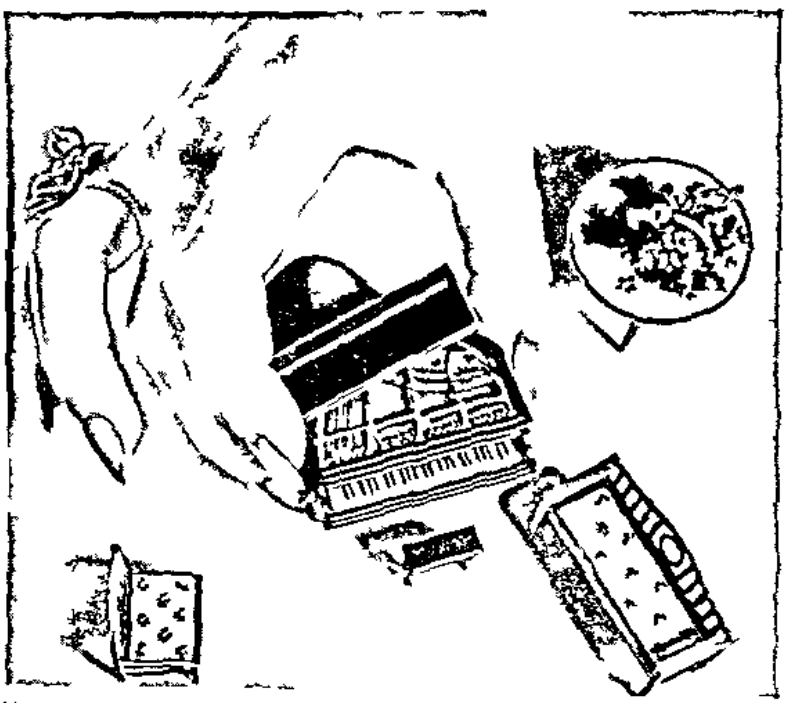


"Spider Web" Forms Gate to Subterranean Wonderland

PATTERNED after a spider web the silvery gate shown above admits visitors to Crystal Cave in Sequoia National Park Calif Its lacy design is in keeping with the delicate beauty of stalactite and stalagmite formations that sight seers will find within the cavern Illuminated to best advantage these natural jewels sparkling in their rocky setting form an underground fairyland newly opened to the public

Tiny Grand Piano Can Be Played with a Toothpick

FOUR craftsmen took six months to build a two-inch square working model of a Steinway grand piano illustrated at right Played with a toothpick it has thirty six ivory keys and is strung like a full size instrument With other objects in the photo —miniature enamel furniture and a dancing girl s toe bell from Bombay India displayed on a finger —it forms part of a private collection of 28 500 curios from fifty four countries exhibited recently in San Francisco



Miniature piano and furniture Note Indian dancer s toe bell on finger



Forepaws around the tree the dog kicks himself up

Climbing Dog Can Tree Himself

WITHOUT a running start, a climbing dog owned by Aaron T Sack of Lowell Wis is able to shinny up trees to a height of sixteen feet The animal climbs straight up by placing its forepaws around the trunk of the tree and pushing up by means of its hind feet.

Want to Build Your Own Car?

AUTOMOTIVE engineers recently calculated how much it would cost to turn out a modern automobile by hand The same machine which costs less than $700 when produced in quantity by mass production methods would cost about $17 850 if made altogether by hand

"Home, James" by Tandem Bike

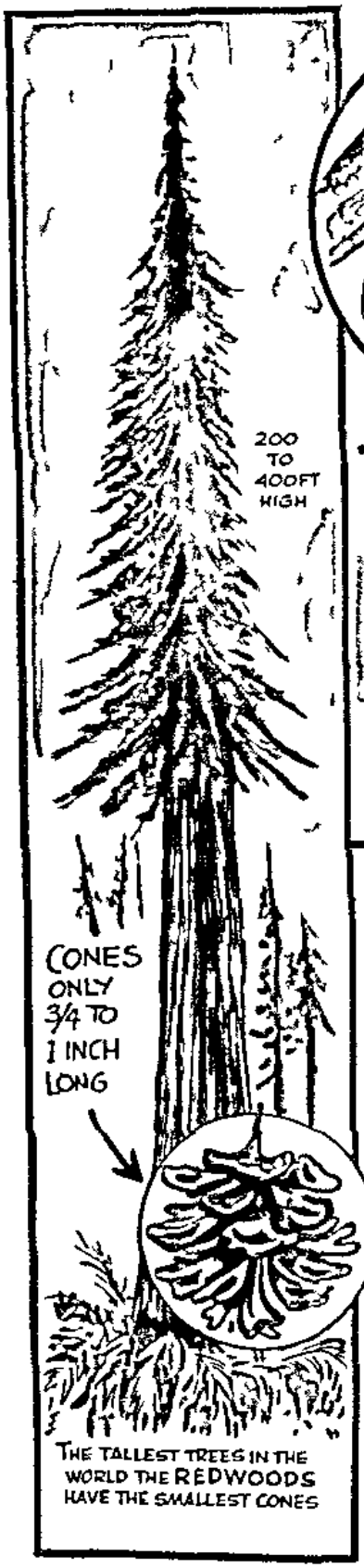
WITH gasoline impossible to obtain for use in private automobiles in Denmark wealthy Danes hire chauffeurs to take them to and from work on tandem bicycles Such cycle chauffeurs do the steering and most of the pedaling Since July the number of bicycles in Copenhagen has jumped from 1 750 000 to 3 800 000



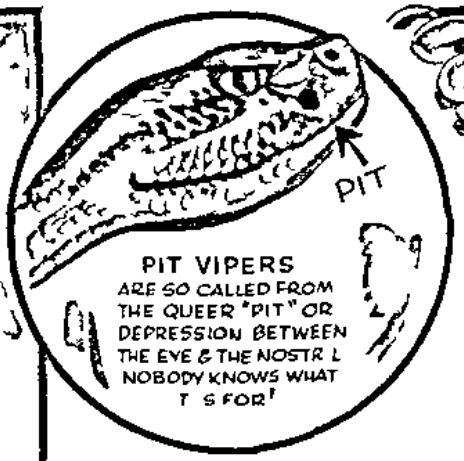
A Danish business man starts home after a hard day at the office

Un-Natural History

BY *Gus Mager*



THE TALLEST TREES IN THE WORLD THE REDWOODS HAVE THE SMALLEST CONES



PIT VIPERS ARE SO CALLED FROM THE QUEER "PIT" OR DEPRESSION BETWEEN THE EYE & THE NOSTR L NOBODY KNOWS WHAT T S FOR!

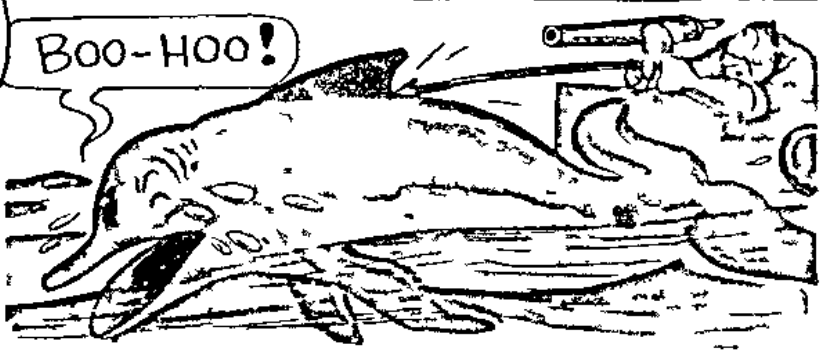


LIKE THE EUROPEAN CUCKOO THE FLORIDA TERRAPIN LEAVES ITS EGGS ON OTHER CREATURES' DOORSTEPS! IT OFTEN LAYS IN AN ALL GATORS NEST LEAVING THE EGGS TO BE HATCHED WITH THE SAURIANS BIG CLUTCH



NIGHT HAWKS NEVER BUILD A NEST OF ANY KIND! WHETHER IN A ROCKY PASTURE OR ON A CITY ROOF THE TWO EGGS ARE LAID RIGHT OUT IN THE OPEN AND THEY ARE SO WELL CAMOUFLAGED THAT THEY ARE SELDOM DISCOVERED!

IT NEVER RAINS CATS AND DOGS BUT FISH AND FROGS DO FALL FROM THE SKY! IN DRY PRAIRIE REGIONS CLOUD BURSTS HAVE BEEN KNOWN TO DROP SALAMANDERS WHICH HAD BEEN CARRIED FOR GREAT DISTANCES!



SA LORS SAY THAT WHEN PORPOISES ARE HARPOONED THEY CRY LIKE BABIES...

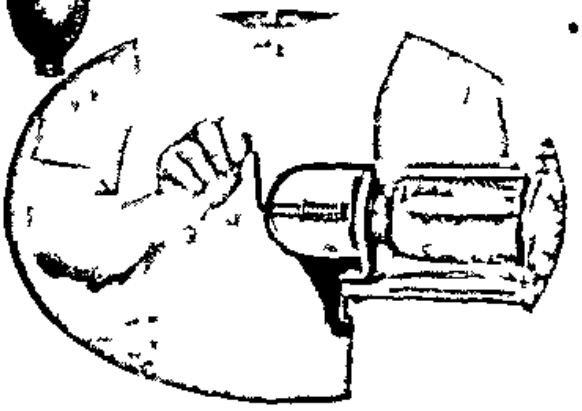
New Appliances



COLD STORAGE FOOD LOCKER Buy ng of food in la ge quant t es when pr ces are low is made poss ble by electr cally operated cold storage receptacles des gned for use n homes



FLASH LIGHT DARNING EGG Inserted in hos ery or under fabr cs be ng mended th s darn ng egg l ghts the work It has a bulb in its blue plast c head and cells in the handle



FRUIT JAR CONDITIONER Irregular and ch pped edges of glass fru t jars a frequent cause of food spo lage are eas ly ground to smoothness w th th s k tchen tool wh ch works on all standard glass fru t jars

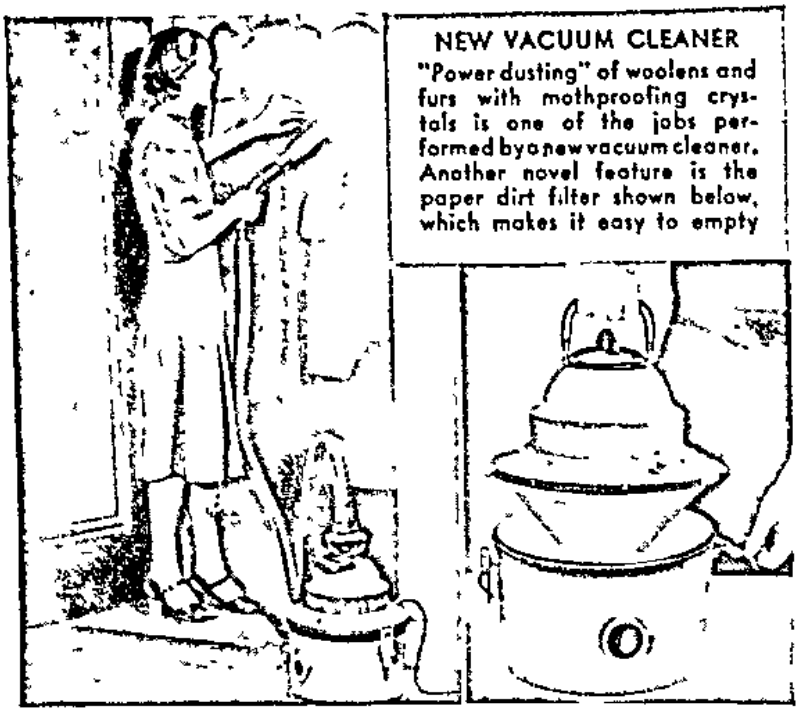


GARBAGE DISPOSAL UNIT Any k tchen s nk can be equ pped for the down the-dra n system of refuse d sposal by install ng the electr cally operated un t illustrated above



SHOE RACK Fastened to the door of a closet this conven ent rack holds shoes in small space Footgear s eas ly hung up by means of spr ng cl ps wh ch gr p shoes as seen in photo

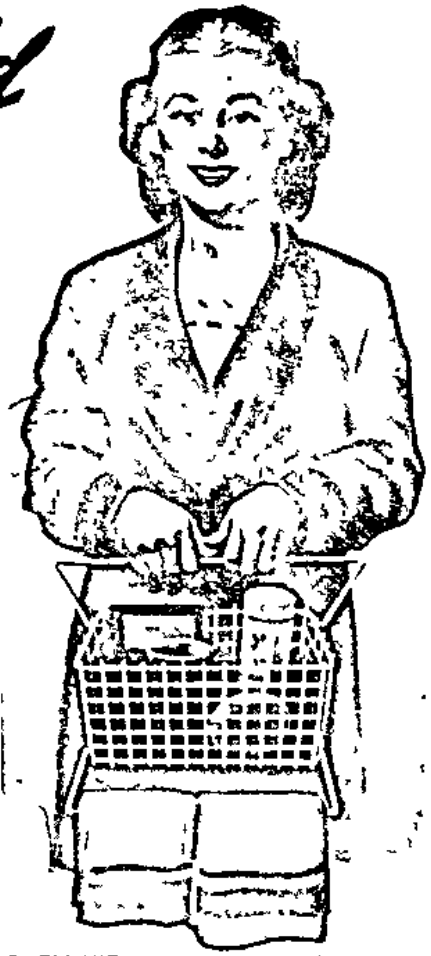
for the Household



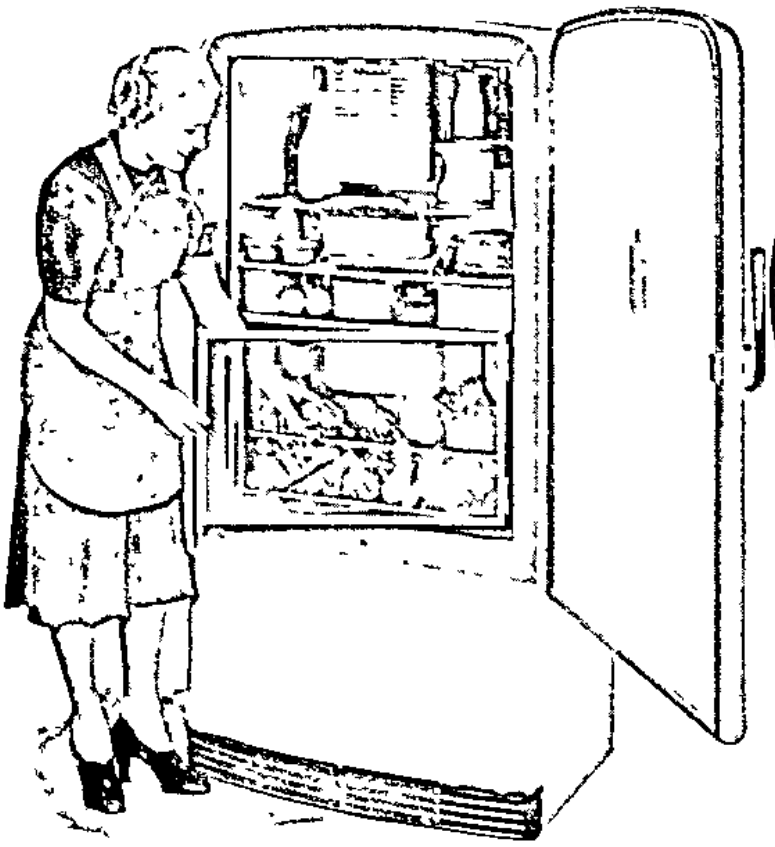
NEW VACUUM CLEANER

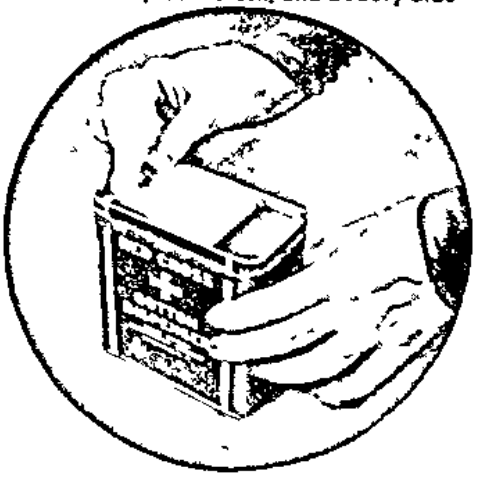
"Power dusting" of woolens and furs with mothproofing crystals is one of the jobs performed by a new vacuum cleaner. Another novel feature is the paper dirt filter shown below, which makes it easy to empty

REFRIGERATOR HUMIDITY CHEST. Foods keep fresher and retain their natural flavor in the refrigerator compartment below, in which the humidity is automatically controlled



BATH KIT. For carrying toilet articles to and from the bathroom, this handy basket accommodates towels, toothbrush, and beauty aids

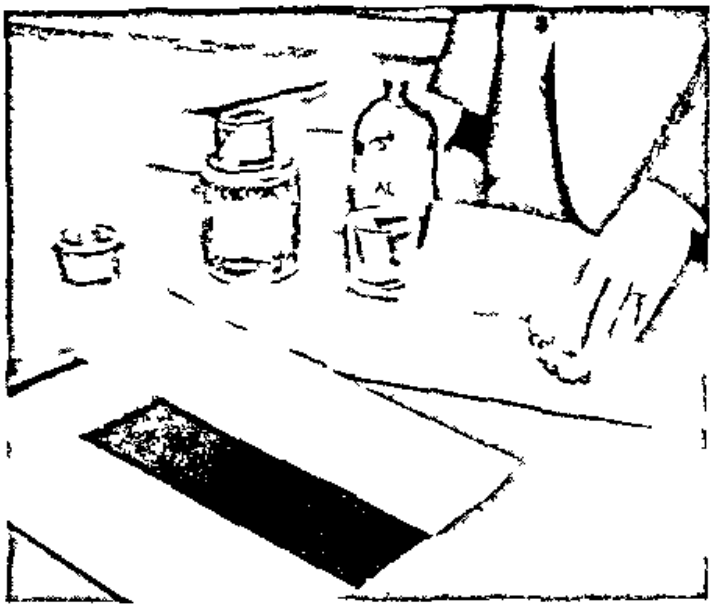




COTTON DISPENSER. Absorbent cotton now comes in a thirty-foot ribbon rolled up inside a sanitary container. In use, the cotton is pulled out through a slot and torn off against a handy cutting blade

New Enamel Resists Both Acid and Fire

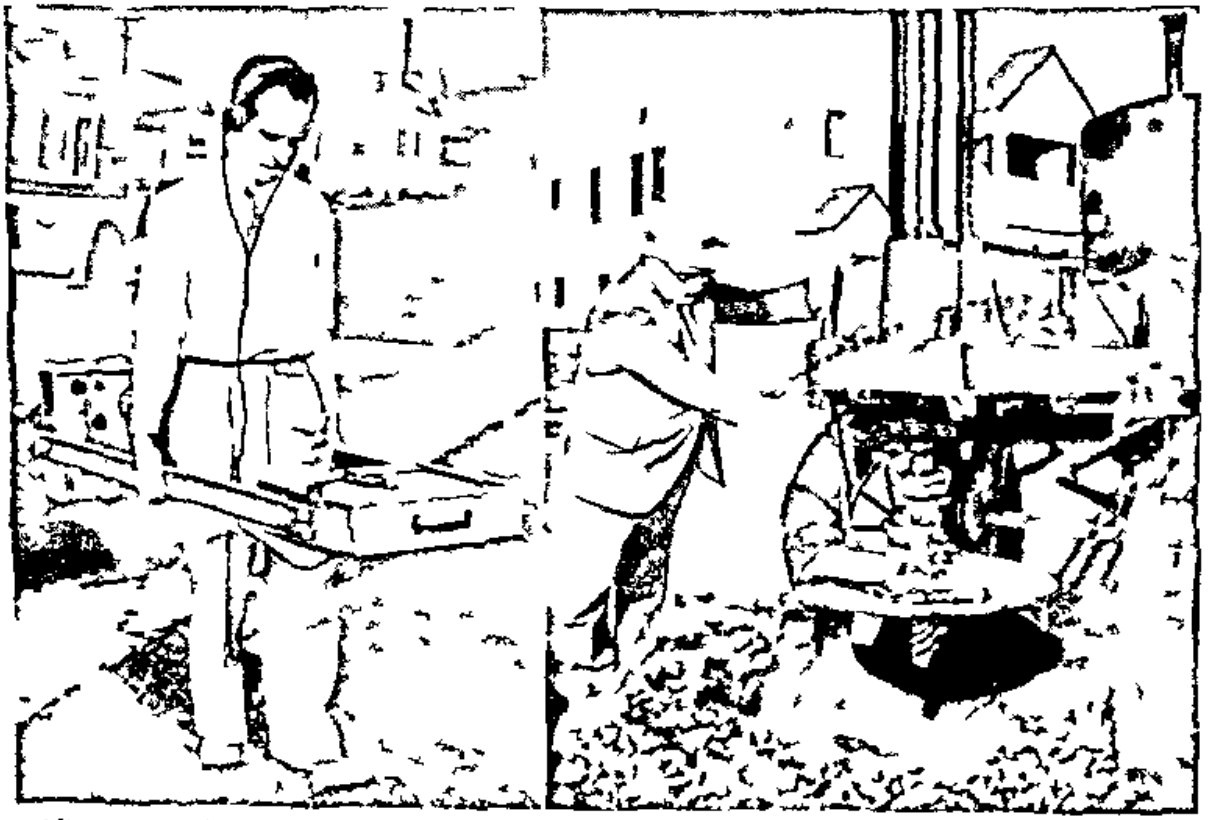
DRAMATIC tests illustrate the durab lity of a new synthetic enamel for indoor or outdoor use Tables or chairs painted with it res st the action of muriat c acid in which z nc read ly dissolves When naphtha is ignited on a painted metal surface and al lowed to burn out soap and water easily wash off the smudge and there is no apparent change in the finish. Available in a variety of co ors the fast dry ing enamel is declared easy for anyone to apply flow ng freely and leaving no brush marks One coat is usu ally sufficient



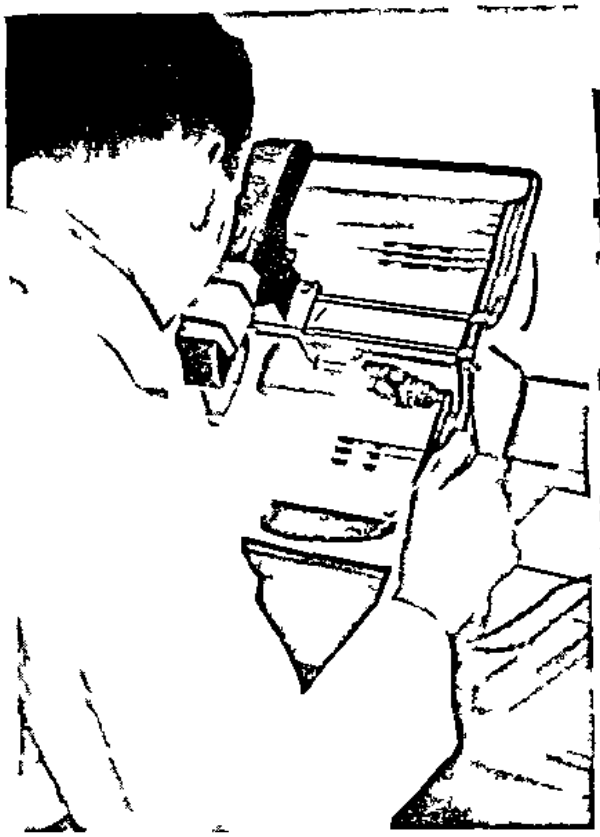
Panels pa nted w th the new enamel surv ve a real ac d test

Giant Auger Bores Holes for Planting Trees in Parks

PLANTING trees has been made an easier task for the park department of Los An geles Cal f by a curious machine that digs the holes for them in short order Just as a carpenter s auger bites through wood so a power operated spinning b t bores a ver tical hole into the soil to the desired depth Small stones and roots are no obstacle to the wh rling blade Lest it encounter a buried p pe line however operators make a prel minary surv ey with a radio locator to make sure the ground is clear of any such obstruction Carried over the area to be planted the device produces a buzzing sound in a pair of headphones when near any underground metallic object



After a rad o locator has made su e that there a e no unde g ound p pes the d ll goes nto act on



Spect um photog aphs made w th the appa atus at the r ght a e compa ed w th standa d spectrums

Below a sample of the so l to Le tes ed s bu ned and the l ght of the flame s spread out for study

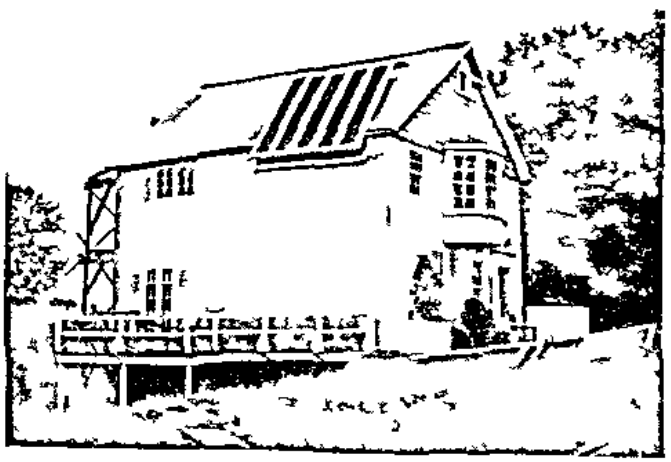


Analysis with Spectroscope Shows Elements in Soil

IN THE laboratories of the Macaulay In stitute for Soil Research in Aberdeen Scotland spectroscopes are now being used to analyze agricultural soils and determine the variety and amount of the elements present. A sample of the soil to be tested is burned in the flame of an acetylene torch, the light from which is spread out into a spectrum for study Photographs of the spectrum made from the flame in which the test soil was burned are then compared with standard spectrums that show known varieties and amounts of elements Thus it is a simple matter to determine what elements the test sample contains and what it lacks for growing various food products

Skylight Harnesses Sun To Help Heat the House

MAXIMUM sunlight for winter warmth was the goal of Henry L. Ross of Media Pa when he re modeled a barn for use as a dwell ing The glass skylight set at an angle into the peaked roof is per pendicular to the sun s rays at noon in m d winter so that a maxi mum of sunl ght will enter rooms on the second story The glass is of a special type that admits ultra violet rays and is laid in two panes which are separated by a dead air space for insulation



Tilted to get the full benef t of the w nter sun the sky l ght catches heat to help wa m rooms on the second floor



Ha y L Bate on w h h un que st awbe ry o e

Queer "Missing Link" Plant Part Rose, Part Strawberry

AFTER th rty years of exper mentation and cross breed ng Major Harry L Bate son hort cultur st of Long Beach Cal f has announced the re creation of a cur ous m ss ng l nk of the vegetable k ngdom a potted plant which he bel eves represents a type wh ch ex sted on earth m ll ons of years ago Accord ng to Bateson h s prod uct forms a link between the rose bush and the strawberry plant Us ng it as a bas s for development he hopes to produce an en t rely new group of fru ts vegetables and flowers One start l ng poss bil ty he fore sees is strawberries that grow on trees

Fruit Mold Kills Bacteria

A MYSTER OUS substance secreted by molds that form on fru t has been found to be valuable in destroying bacteria n re searches by Dr Edwin C Wh te of Johns Hopk ns Hosp tal Balt more Md

Try-Out Room Shows How Furniture Will Look at Home

TAKING a t p from the stage a New York furn ture store has installed a try out chamber n wh ch movable walls can be adjusted to reproduce the s ze and shape of any room a customer is furn sh ng Spot l ghts color the walls to match the actual apartment The customer thus sees how furnishings w ll appear when installed.



A ang ng ad v table walls n a fu nitu e d splay oom to dup cate the s ze and shape of an apartment n the cu tome s home Colo ed spotl ght as at the ght g e any t nt de ed

AUTOS

How To Avoid Traffic Jitters • New Car Faces for 1941 • Tips That Will Help You Keep Your Car in Shape



Do You Get



DON'TS

1 Don t f ght traff c Instead of fret ng and fum ng save your nerves for more im portant th ngs

2 Don t dr ve under phys cal stra n Make yourself as comfortable as you can w th seat adjustments and cush ons

3 Don t argue w th other dr vers Bawl ng out the other fellow does no good and merely frazzles your own nerves

4 Don t tolerate bugs in your car A smoothly runn ng mach ne s good nsur ance aga nst traff c j tters

5 Don t dr ve a no sy car Knocks squeaks and rattles dull your senses and slow up your react ons n emergenc es

6 Don t neglect to wea glasses if you need them Eye stra n adds to general nervous stra n when you are dr v ng

7 Don t dr ve so fast that you lose the feel ng of complete control over your car Conf dence is what keeps your nerves calm

Sc ence takes the dr ver for a r de Hooked up to instruments that record h s heartbeat blood p essure and nerve tens on th s motor st s be ng tested on the road for react on to stra n

IMAGINE that you are driving your car at a good clip down a boulevard running through the residential section of a city The road is wide and uncluttered by traffic Your car purrs along smoothly Suddenly with no warning whatever a woman darts out from the sidewalk and throws herself directly into your path

What will your reactions be? What will *be the effect on your nerves? How will the* shock of the experience affect your subsequent driving?

California scientists can answer these questions exactly For recently they have been hurling bodies—stuffed dummies of course but drivers don t realize that at the time—in front of automobiles as one phase of an elaborate series of road tests to de termine how the hazards of automobile driving affect the nerves and consequently the driving ability, of the average motorist

Traffic JITTERS?

By
R. DeWITT MILLER

Their conclusions afford valuable hints on how all drivers can combat traffic jitters

The tests which utilize specially designed electrical apparatus were developed by Dr George Mount, a prominent psychologist working in cooperation with the Union Oil Company of California In designing the instruments to check the nervous reactions of drivers Dr Mount and his associates followed the principle that a person s nervous tension will be clearly indicated in three main ways by his heartbeat by his blood pressure and by the electrical sensitivity of his skin—for the electrical resistance of your skin changes in direct proportion to the state of your nerves

By means of pick up microphones attached to wrists and chest instruments for recording heartbeat and blood pressure were easily adapted to the problem of making continuous records while a driver was actually operating a car under traffic conditions The development of a method of recording changes in skin resistance however required months of research before an acceptable solution was found

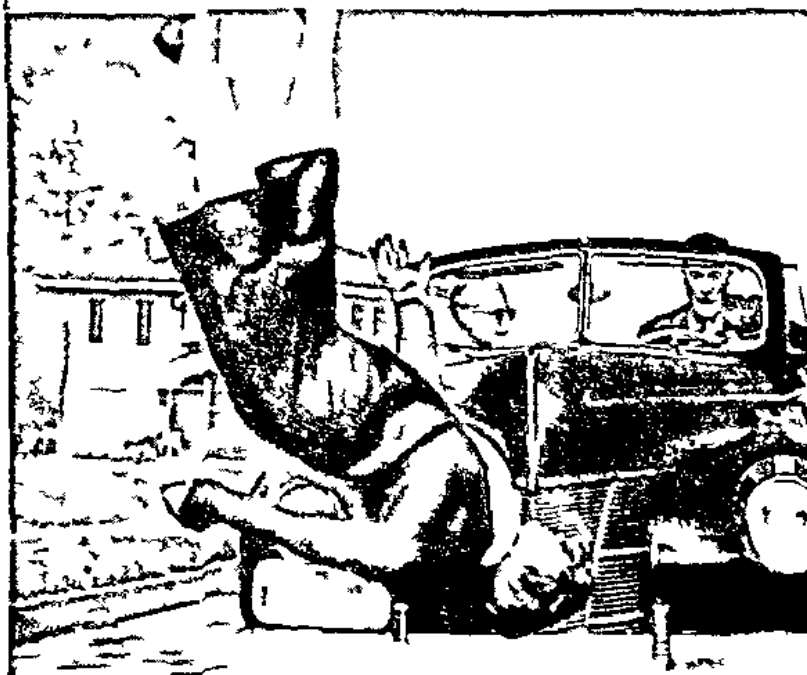
Electrodes are attached to the drivers hands Between the electrodes and the skin a special saline jelly is used to insure a good contact From the electrodes wires lead to recording instruments resting on the rear seat of the car By means of a pointer and dial the drivers skin resistance to low amperage currents can be determined at any instant Thus this

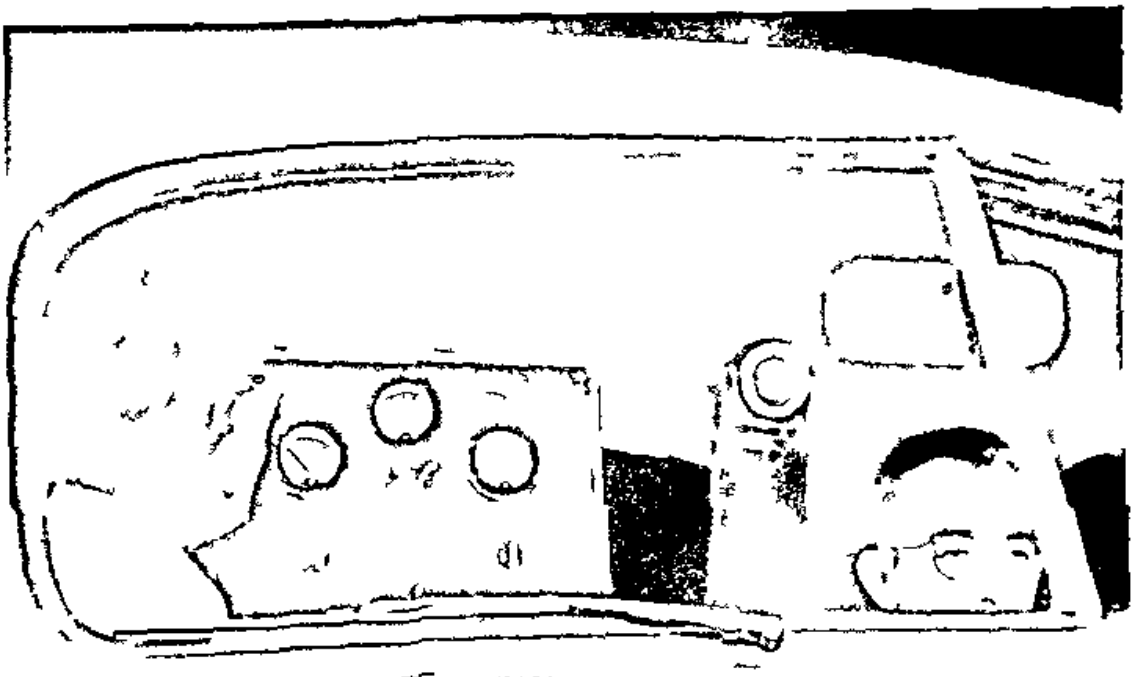


Blissfully unconscious of what lies ahead the guinea pig driver spins merrily along on a boulevard nearly empty of traffic

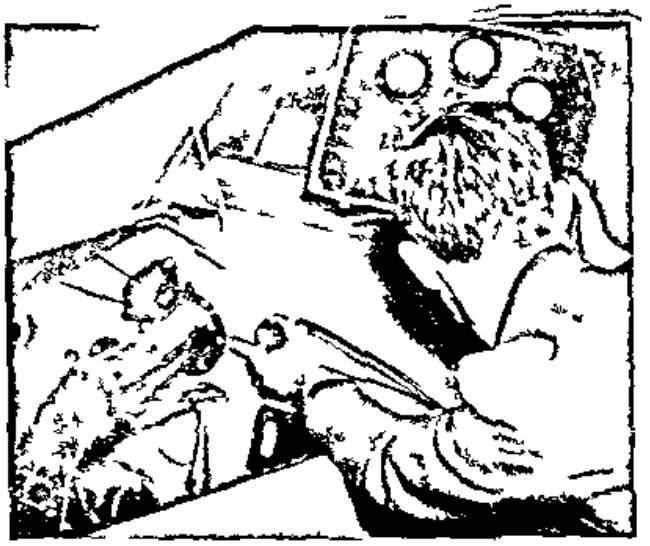


when suddenly from behind a tree a body hurtles through the air into the path of the speeding car Note the drivers expression below Meanwhile the instruments keep on recording

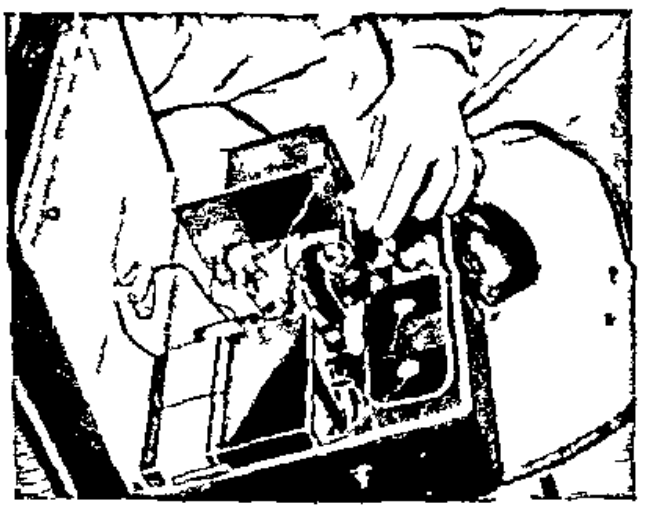




Car noise was found to be an important factor in traffic jitters. Above an instrument counts decibels at the driver's side



Another method of checking up on noise is to pick up vibrations of the engine bulkhead as illustrated here



Inside view of a portable instrument which writes a continuous record of the action of a subject's heart

apparatus together with the heartbeat and blood pressure instruments writes a running story of the nerve responses of the driver as he meets the numerous problems of traffic in congested areas.

When hundreds of subjects had been tested on the road with this equipment the California scientists discovered that there are two distinct types of nervous strain brought on by traffic driving: steady strain and shock strain.

Steady strain is the general nervousness that accumulates during difficult driving regardless of whether the motorist encounters any emergencies during the trip. In thirty minutes of traffic driving the nervousness of the average motorist, the psychologists determined is increased twelve percent by this steady strain.

Naturally steady strain will be further increased by shock strain, the type that occurs when a driver just misses a jaywalker, can't stop for a suddenly changed traffic signal, realizes that his brakes have failed or is confronted with a similar emergency. Shock strain it was found will increase a driver's nervousness by as much as twenty seven percent in a half hour of traffic driving.

Twenty seven percent seems a tremendous jump but the scientists point out that one close call in traffic will speed a driver's heart action as much as

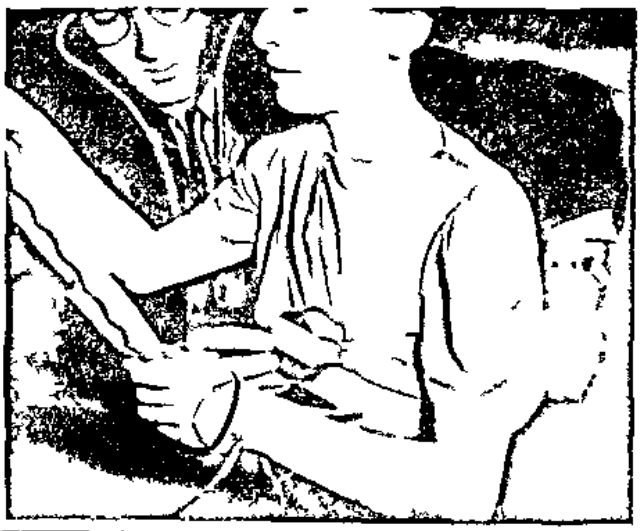
twenty-five beats a minute At the same time, the resistance of the skin to electrical currents makes a similar change, blood pressure skyrockets, and muscles become tense Incidentally, it is interesting to note that women proved to be thirty percent more nervous than men after similar traffic-test drives In general Dr Mount states, women are less affected by steady strain and more by shock strain than men

FROM these traffic tests the scientists also discovered what they term a short-circuit reaction This occurs when a driver responds automatically to a traffic problem without any conscious thought about it Certain of these short circuit reactions can become dangerous If a driver applies his brakes in any and every emergency he will eventually form a short circuit reaction by which he will automatically brake without conscious thought of what he is doing Then one day an emergency will arise when applying the brakes would be the worst possible action to take—during a skid on a wet pavement for example

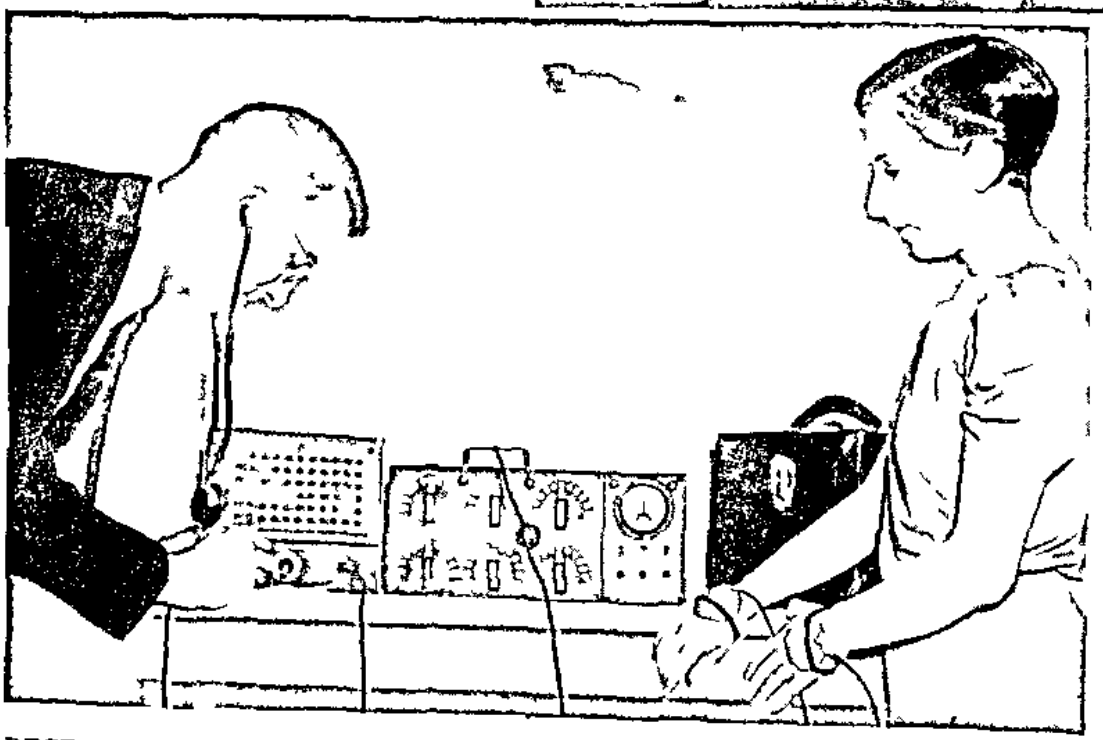
To prevent this the scientists suggest that all drivers look out for the first indications of any type of short-circuit nerve reaction and then combat it before it gains headway This can be done, they state, simply by occasionally forcing yourself to think *why* you stop or accelerate your car in a given situation, before you actually do it

Noise is another element that has a bearing on traffic nerves, the investigators found By spotting sensitive microphones to record the sound volume inside of several cars, and then having subjects drive the cars while their reactions were checked, the scientists discovered that car sounds definitely affect driving ability

But, strangely enough, the effect of car noise on a driver is to decrease the efficiency, not of his sense of hearing but of his senses of sight and smell, and his speed of nerve reaction This agrees with the psychological principle that when one sense is overstimulated, the other senses are dulled



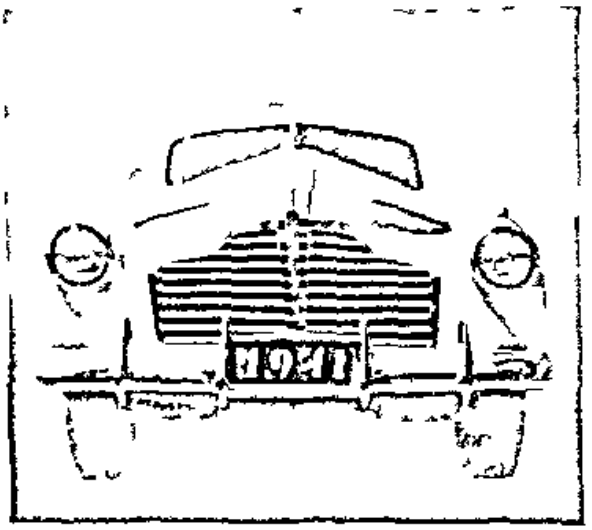
A microphone placed over the driver's heart picks up the heartbeat while electrodes on wrists help determine electrical resistance of the skin as demonstrated in the experiment below



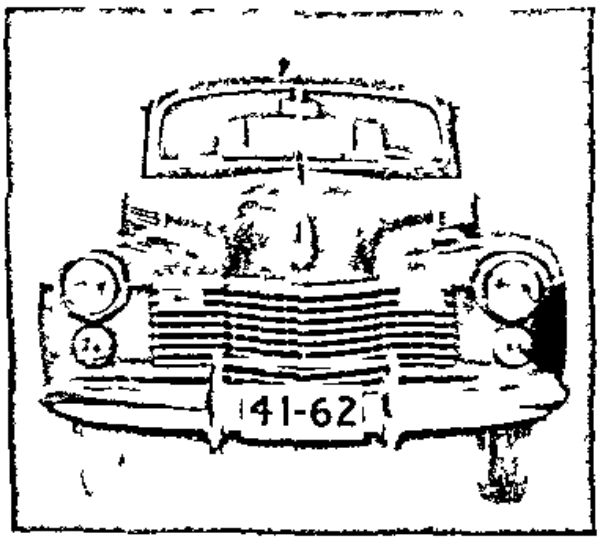
NEW CAR FACES FOR 1941

WHETHER its body styling engineering refinements ingenious accessories or any or all of these, there is something brand new in every car, every year That 1941 is no exception is apparent and the explanation is written on the faces of the new cars presented alphabetically on this and the following pages

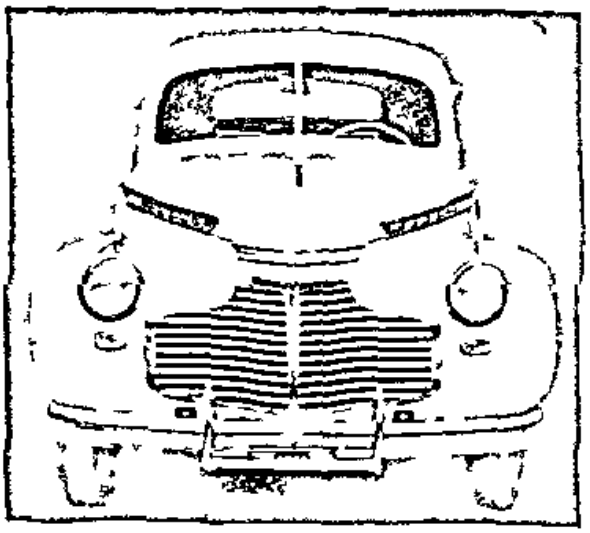
Outstanding body-design features on the new cars are concealed running boards wider radiator grilles and heavier bumpers The fenders mostly have flatter tops while several have nearly perpendicular skirts dipping low and adding to the feeling of solidness On several cars, the more gracefully curved hoods are lower for increased visibility and wider where they fair into the windshields to conform to the generally increased width of the bodies and seats Tops are lower, while headlights are in most cases spaced farther apart And built into these cars are factors of safety, comfort, economy, durability and driving ease to please the most critical tastes of America's motorists



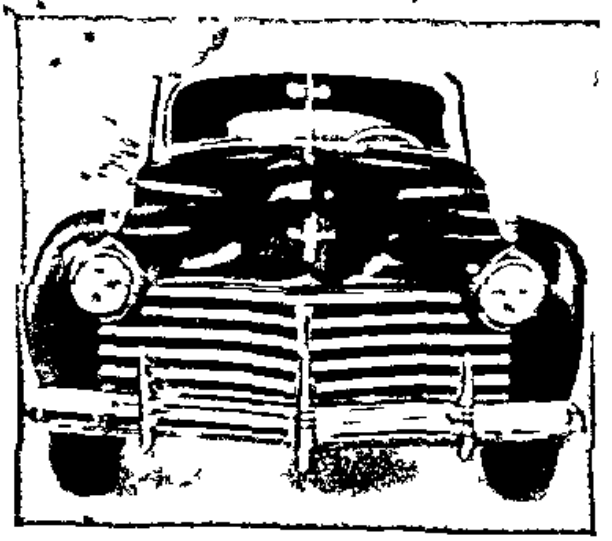
BUICK Redesigned piston heads higher compression and two dual carburetors step up the power in the new more massive and streamline Buicks



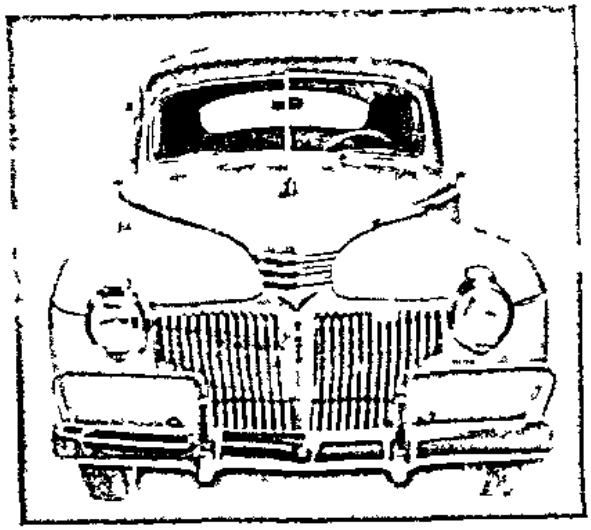
CADILLAC boasts a 150 horsepower motor in each of its six lines, and invades the medium price market It has an optional economy rear axle ratio



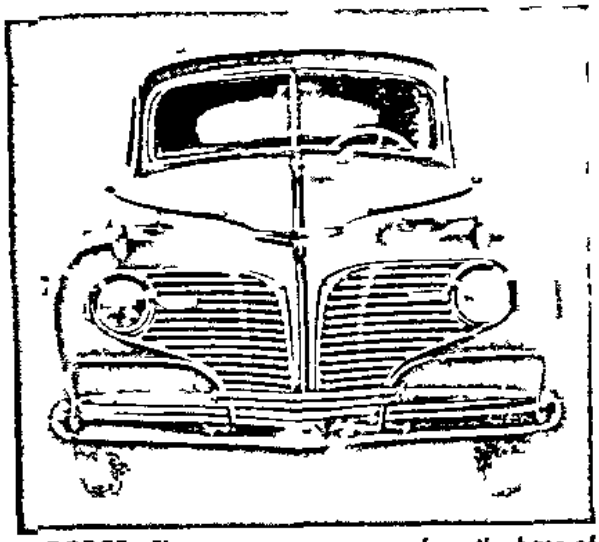
CHEVROLET wheelbase and body are longer; body is lower and more massive Concealed steps replace running boards; headlights blend into fenders



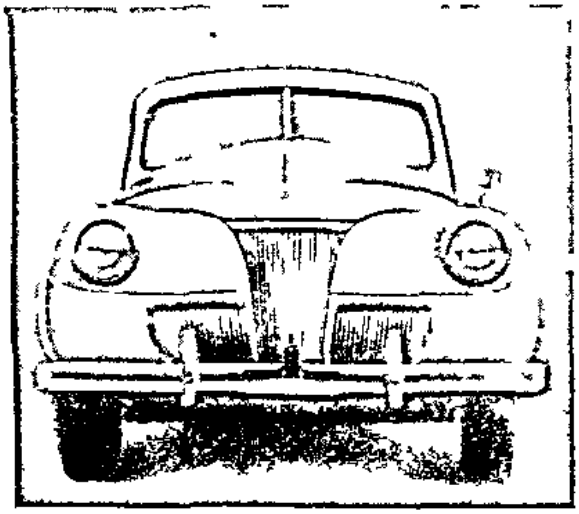
CHRYSLER Fluid drive is available on both the sixes and eights with a high gear improvement The front end design stresses horizontal lines



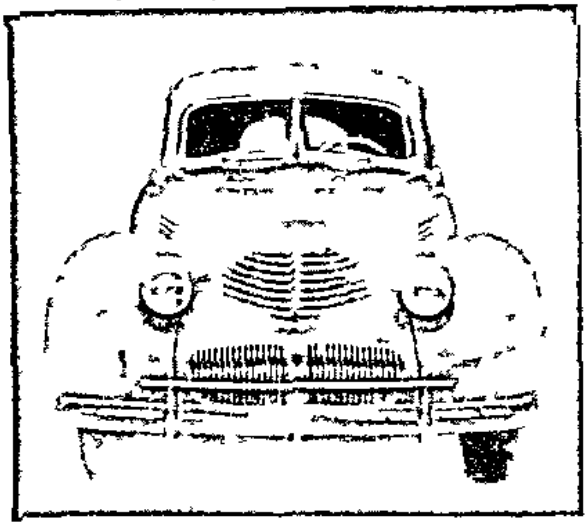
DE SOTO, at 105 horsepower also offers fluid drive as do Dodge and Chrysler Fender tops are flattened and made in one p ece w th hood sides



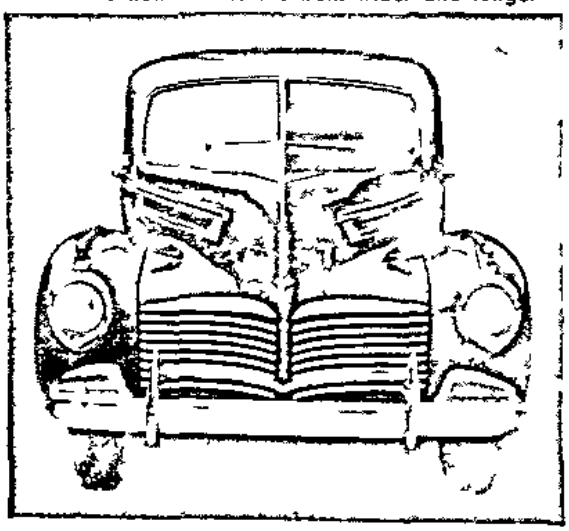
DODGE. Flowing curves sweep up from the base of the rad ator grille reach ng all the way to the headlamps (Bumper attachments shown are extras)



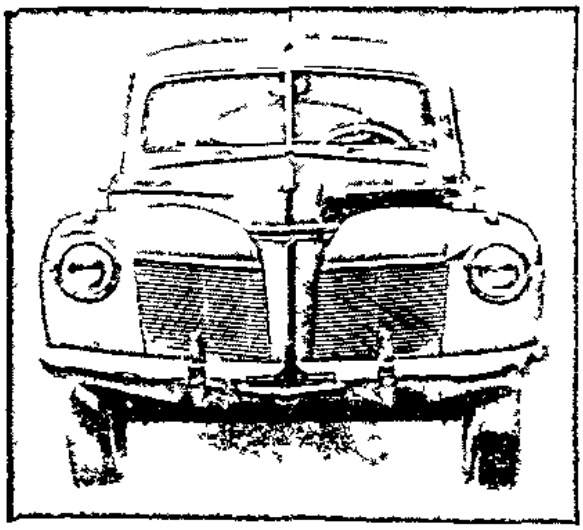
FORD front ends show new fender treatment and rad ator grilles are recessed somewhat into the metal The new bodies are both wider and longer



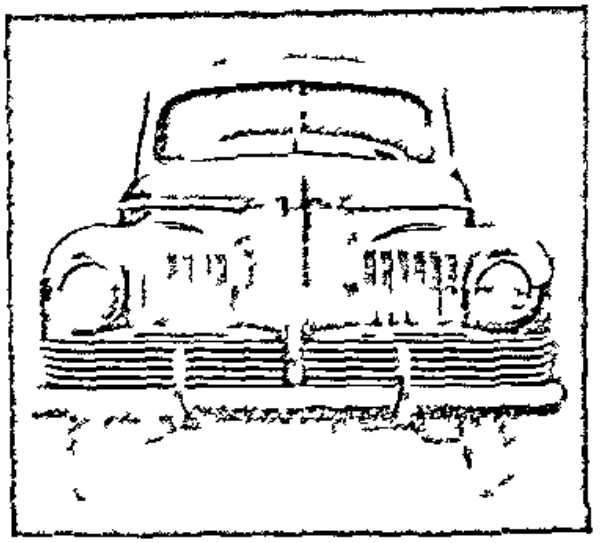
GRAHAM offers four l nes starting in the medium price field many ava lable with superchargers The Hollywood shown has exceptionally low floor



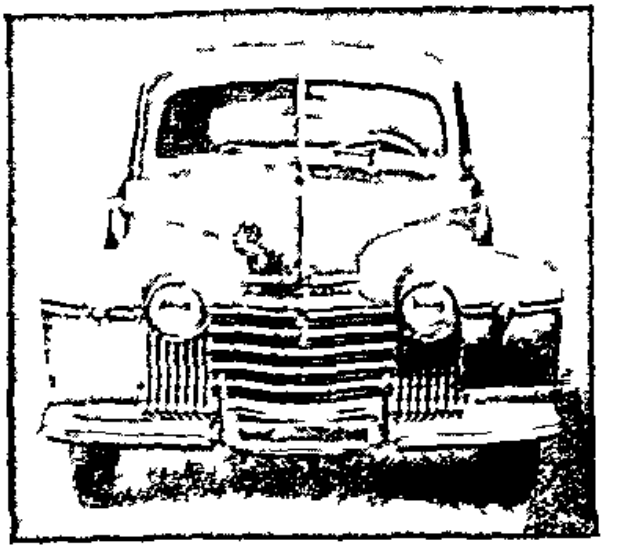
HUDSON Symphon c styl ng—meaning harmonious two tone colors inside and out—is stressed by Hudson, along w th its brand new transmission



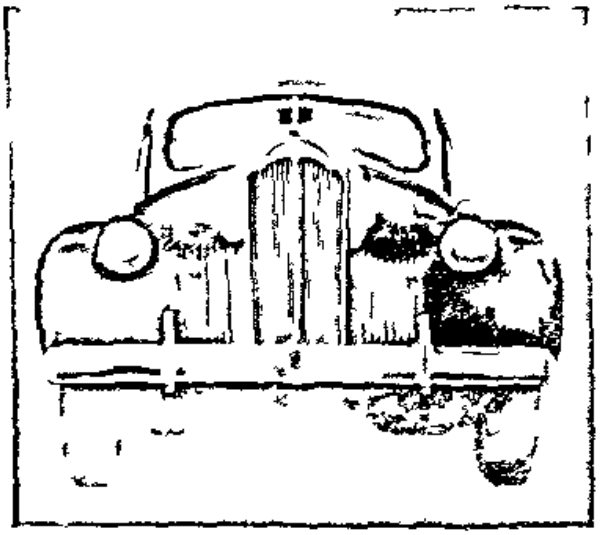
MERCURY, roomy powerful medium price line of Ford made cars offers numerous engine and chassis refinements, with lower, wider bodies



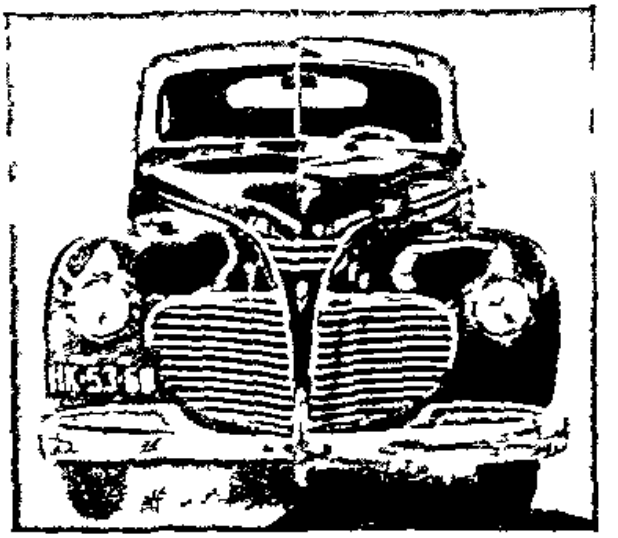
NASH en e s the low pr ce f eld w th an all new car slung on co l spr ngs at all four wheels and hav ng chass s and body welded as a s ngle unit



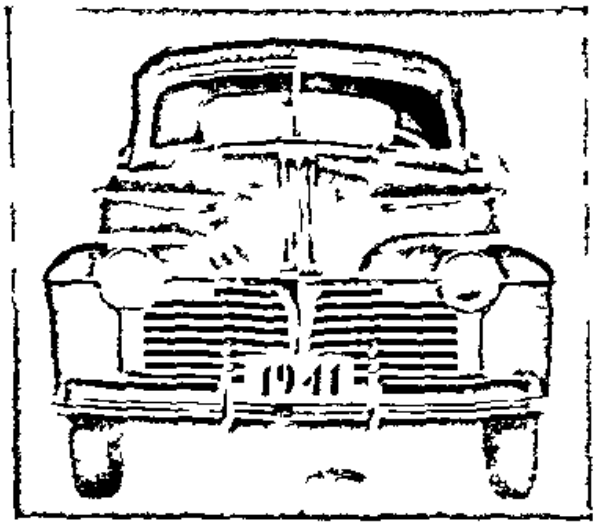
OLDSMOBILE has s x l nes—three s xes and th ee e ghts—w th strong fam ly resemblances New bumpers protect the f ont and rear fender sk rts



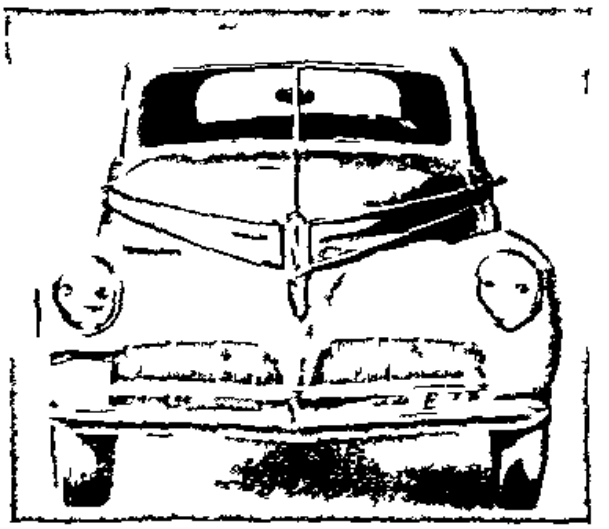
PACKARD offe s s xes e ghts and super e ghts w th st k ng innovat ons n all l nes The fa- m l ar rad ator outl ne st ll d st ngu shes t



PLYMOUTH more powerful has a new gr lle de s gn A new second gear is used for most start ng and a vacuum power gearsh ft is ava lable f des red

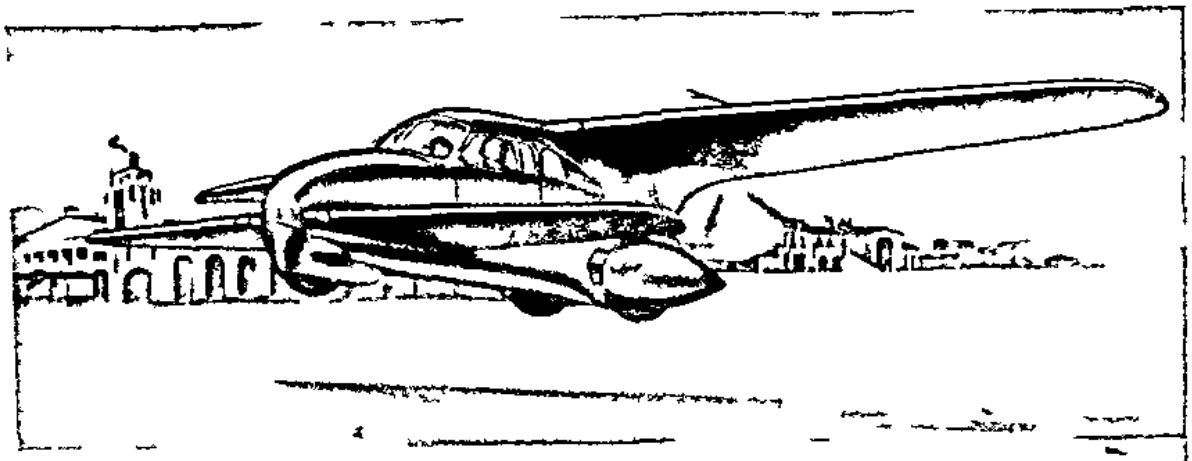


PONTIAC. Th ee sepa ate torpedo l nes w th many models n each a e ava lable w th e ther s x or e ght-cyl nder eng nes Appo ntments a e restyled

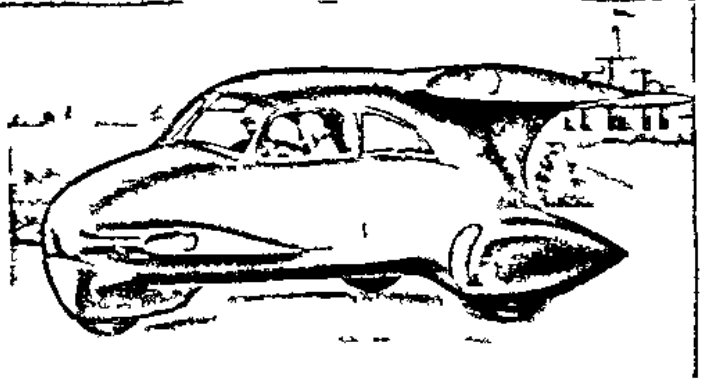


STUDEBAKER in all models of its three l nes is room er more eye st k ng and respons ve to the accelerator also offers a lo pedo-type car

Detachable Wings Turn Three-Wheeled Car into a Plane



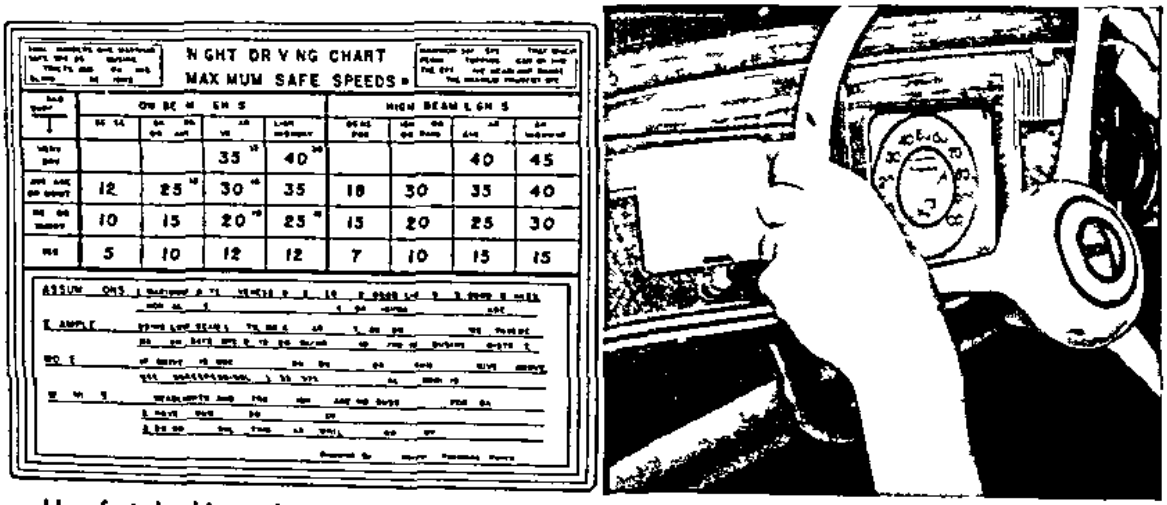
A HYBRID land and air ma chine with wings that can be shed on landing is proposed for quantity production by a Dayton Ohio inventor and manufacturer The machine called by its designer an Aerobile is said to have passed wind tunnel experiments although no actual flying tests have been attempted The body of the craft forms a three wheel tor pedo shaped car for road driving after the wings have been removed The machine is driven by a pusher propeller when it takes to the air



The comb nation automob le a rplane on the road In the upper p cture it is tak ng off as a plane w th ts detachable w ngs in place and a pusher propeller

Headlight Chart Shows Safe Speeds for Night Driving

SAFETY charts for night driving have been worked out as the result of hundreds of tests by W W Harper nationally known traffic expert of the Pasadena Calif Police Department The charts give the safe speeds under different driving conditions Placed on the instrument panel of the car in front of the steering wheel the chart can be consulted at the beginning of a trip After a few days the safe speeds will be memorized and reference to the chart will not be necessary any longer



NIGHT DRIVING CHART
MAXIMUM SAFE SPEEDS

	ON BEAM LIGHTS				HIGH BEAM LIGHTS			
			35	40			40	45
	12	25	30	35	18	30	35	40
	10	15	20	25	15	20	25	30
	5	10	12	12	7	10	15	15

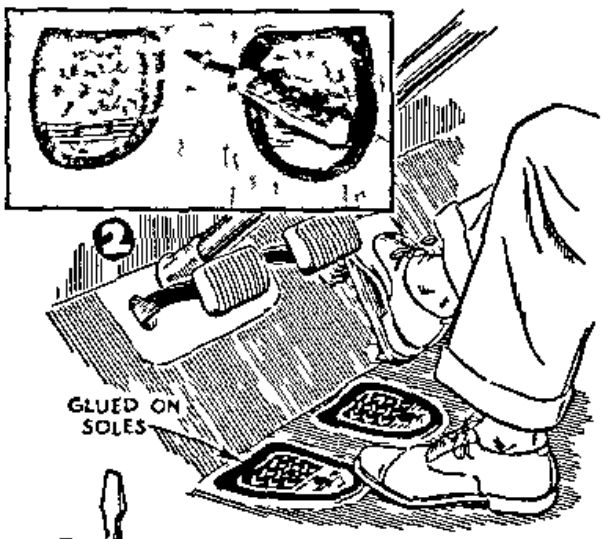
How fast should you dr ve at n ght? Th s chart placed on the dash as shown tells you at a glance

PRACTICAL HINTS



1 AS A SAFETY FACTOR for winter driving as well as a convenience an electric defroster fan mounted on the deck space behind the rear seat of a car and aimed at the rear window is as effective as one used on the windshield It keeps fog and frost from forming on the inside and melts snow and sleet that gathers on the outside while parked or driving It may be easily wired from the ammeter and ground through a dashboard switch —W P H

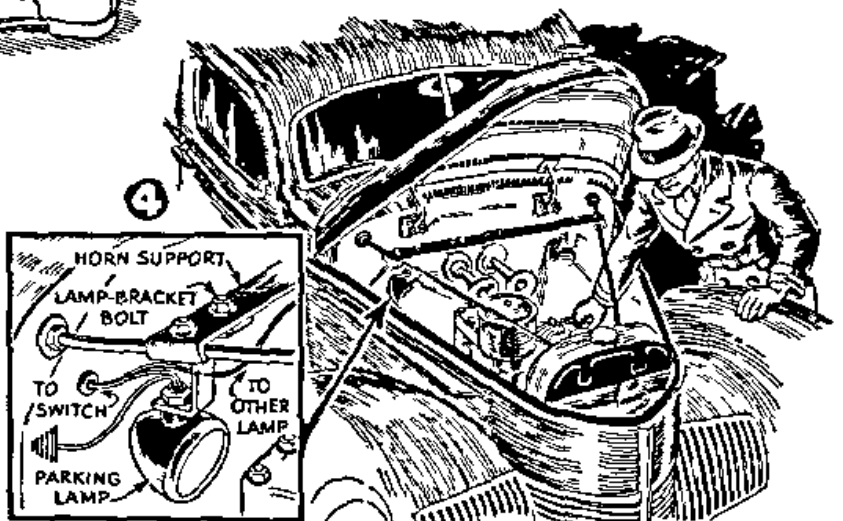
2 FLOOR MAT PROTECTORS consisting of a pair of five and dime store shoe soles of the stick-on variety are easy to attach underneath the brake and clutch pedals of your car They are usually available with a supply of glue and a scraper and will protect the floor mat from the scuffing of your heels —A. O S



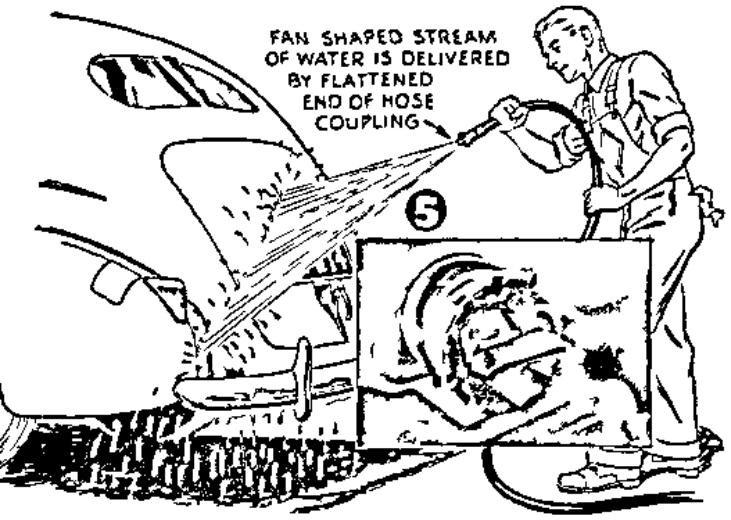
3 A HANDY WRENCH for loosening or tightening the terminal nuts found on most spark plugs can be made by simply drilling a hole slightly smaller than the outside diameter of the nuts in the handle end of a screw driver The hard wood wrench will loosen tight nuts without damage —W C W

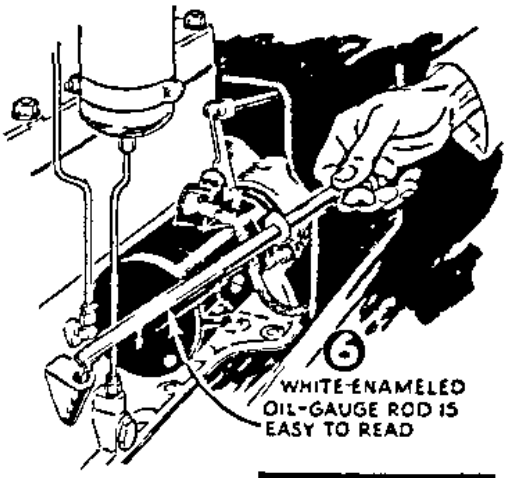


4 TROUBLE LAMPS mounted under the hood and connected to a dashboard switch are a boon when you have engine trouble on country or unlighted roads at night I purchased two old cowl lamps and fittings from a junk dealer and connected them as shown In some cars it may be found easier to attach them directly to the fire wall or the radiator tie rods —E. F, Jr



FOR CAR OWNERS





5 **A FAN SHAPED SPRAY** of water for washing cars is obtained without the necessity of holding a thumb over the end of a hose by means of an inexpensive device This consists of a ten cent hose coupling with the inner sleeve squeezed flat in a vise The coupling is then screwed on the end of the hose like a nozzle when needed to deliver a strong rinsing stream of water to the work —E. M

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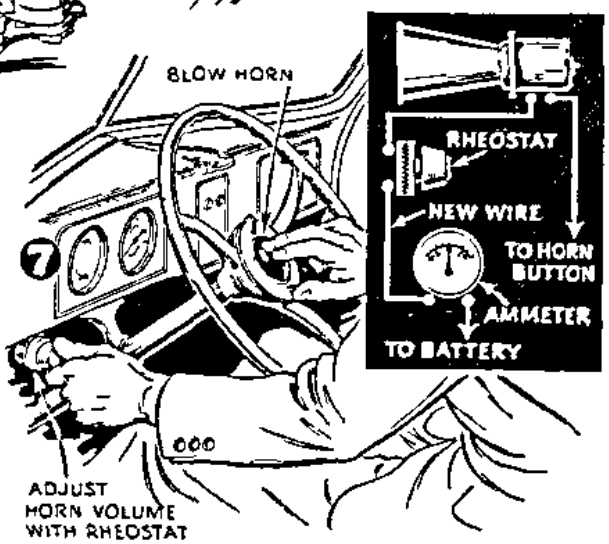
6 **QUICKLY SHOWING THE OIL LEVEL** a white-enameled measuring rod or dip stick is much easier to read even if the oil is cloudy from long use The rod should first be cleaned and then given two coats of high quality enamel Brush the enamel only up to the full mark so that you can still tell when your crankcase is filled —E H

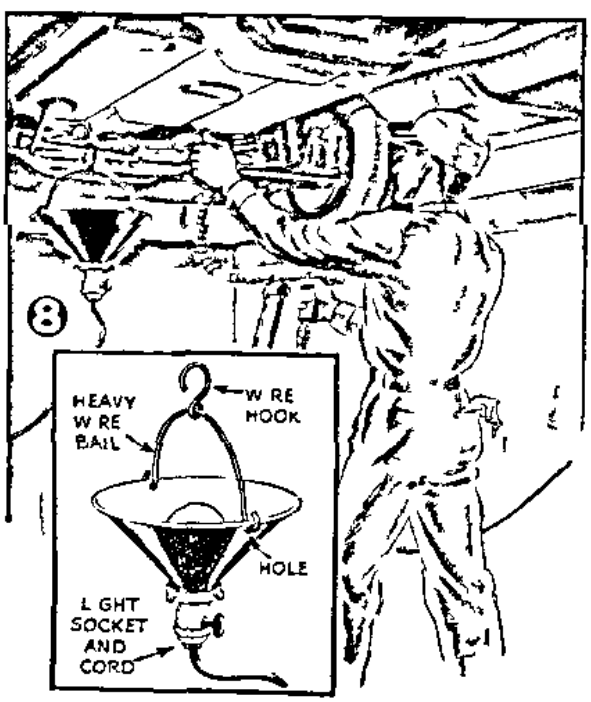
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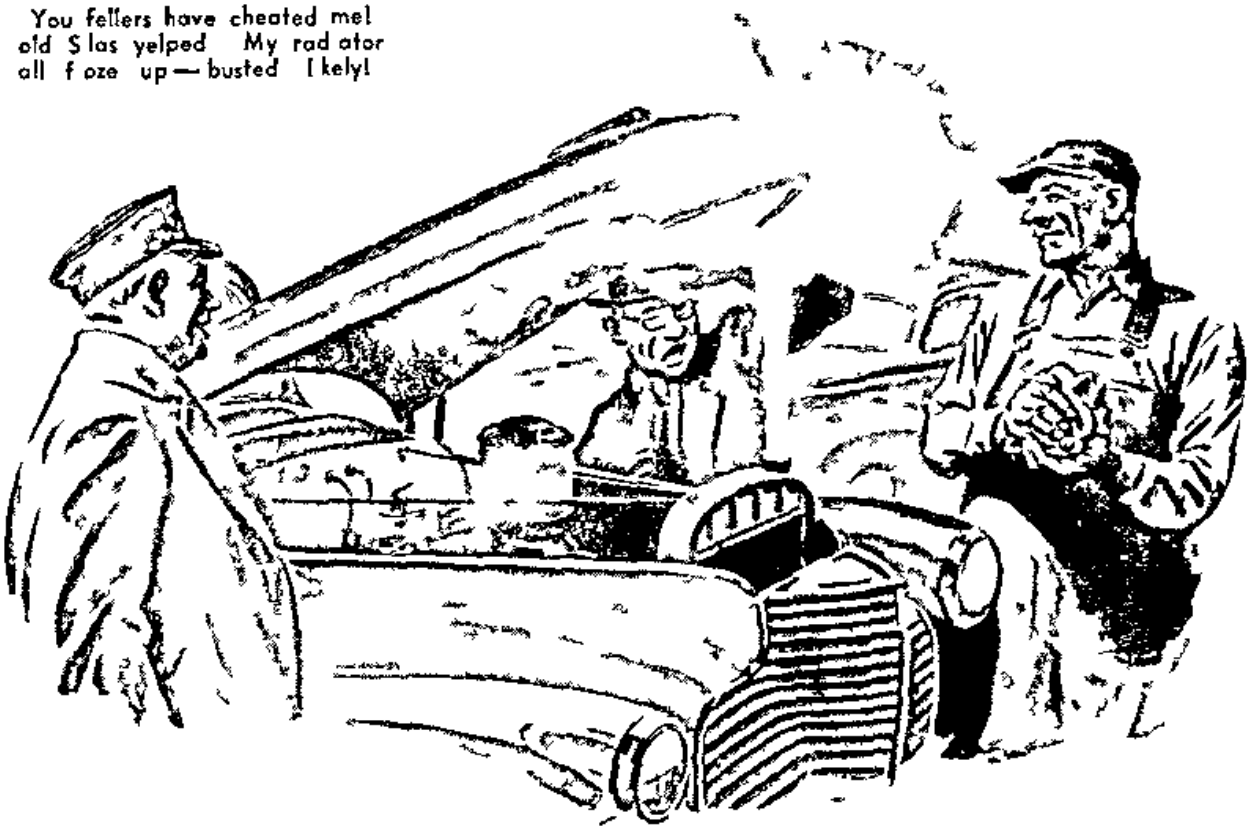
7 **TONING DOWN YOUR HORN** for city driving is possible on many cars by placing a rheostat in the horn circuit and mounting it on a convenient spot under the dash If the horn operates through a relay be sure and connect the rheostat into the relay circuit, not into that of the horn button —P M

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8 **FREEDOM FROM GLARE** while working beneath a car in a greasing pit or under a car hoist at night is obtained by replacing the unshielded wire guard of your trouble lamp with a metal cone as shown With a little ingenuity you can rig up the outfit with a piece of sheet iron a length of wire and a hook shaped as in the sketch for attaching the device to the underside of a car wherever it is needed —L B R.







GUS Gets Ready for Winter

SNOW sweepers swished on the road outside as Gus Wilson shed his ulster in the shop of the Model Garage on the first real winter morning of the cold weather season A heavy fall of the white stuff early the evening before had been followed by the mercury taking a nose dive and now at eight o clock of a sunny w ndy morning the thermometer outside the office door registered only ten above zero

Gus s partner Joe Clark was grinning a good morning from the office door You ll have a bad case of telephone ear by nine o clock Gus told him All the customers who as usual didn t remember to take the precaution we advised will be phoning us to get their frozen up busses started It s always that way the first real cold morning of the winter

Sure is Joe agreed It s hard on the ears and it makes you wonder why the Lord made so many people downright care o less but it s good for our business. Remem ber that morning when—

He was interrupted by the honking of a horn outside the shop doors Then someone shouted Hey you Gus Wilson—open up! It s colder n heck out here

That s Ez Zacharias Gus said as he unlocked the double doors I didn t expect he d be the first one to holler for help Usually he s a pretty wise bird when it comes to keeping out of avoidable car trou ble

Ez usually covers his R.F D route in a smart looking sedan but this fall he in vested in a light truck three or four years old but in A 1 condition for use when the dirt roads back in the country get bad or around the holidays when he has especially heavy parcel post deliveries to handle

He drove this truck into the shop leaned from the seat, and scored a V on Gus s waste box with an active service charge of tobacco juice By gum he said the feller who sold me this darn truck took me fer a sucker and he d dn t make no mis take He climbed out pushed his post man s cap away back on his shaggy head and shook a big and hairy fist at the vehicle First time I ever seed a automobile that d run ahead smooth as velvet, but wouldn t

The Boss of the Model Garage Tells You How To Avoid Being Chased off the Road by That Old Man Zero Weather

• • •

By MARTIN BUNN

back up without goin' dead Took me a good ten minutes to get backed out of my ga-rage, by hookey! Every danged time I put her into reverse she'd die down, start up again, hit a few times and then quit like a yaller dawg on me! Take a look at her, will you Gus?'

Gus got into the truck, stepped on the starter, and shifted into reverse The truck ran smoothly over the shop floor, but the moment its rear wheels hit the snow-covered driveway outside, the engine sputtered, and then went dead When he stepped on the starter again and shifted into low the truck ran back into the shop without a miss

"That s a new one on me ' he said First time I ve ever known a car to act like that.

Gus checked the points and condenser and found them in excellent condition When he restarted the engine it ran smoothly He again backed the car out of the shop As soon as its rear wheels were on the snow-covered driveway he noticed that there was a lot of vibration—so much that he could feel the engine moving back and forth on its rubber mountings As soon as he shifted into low speed the vibration ceased and the truck ran smoothly back into the shop

When he raised the hood his eyes still were so badly dazzled by the glare of the bright sun on the newly-fallen snow that he could scarcely see the engine That was why he noticed the faint flicker of a spark where the wire entered the condenser When his sight returned to normal he saw that one of the strands of the wire had frayed loose, and that its ragged end was close to the condenser

He examined the truck s rear end, and nodded when he saw that its spring suspension was like that used on some old-model passenger cars—a half conventional spring, with one of its ends connected to the frame and the other to the rear axle Without further checking he replaced the frayed wire with a new one 'All ready to roll" he told Ez as he lowered the hood

'Yeah?" the postman said "What the heck was the matter with her?"

"A strand of frayed wire was hitting against the condenser and shorting your engine, Gus told him

'What? That don t make sense" Ez objected "The engine ran swell except when she was in reverse"

'That's what fooled me,' Gus said "The answer is that, with this particular type of spring suspension, the wheels pulling backward in the snow cause a sort of bouncing motion That motion makes the engine rock on its mountings, and that rocking brought the end of the frayed wire into contact with the condenser and caused the short that killed your engine whenever you went into reverse in the snow Get it?"

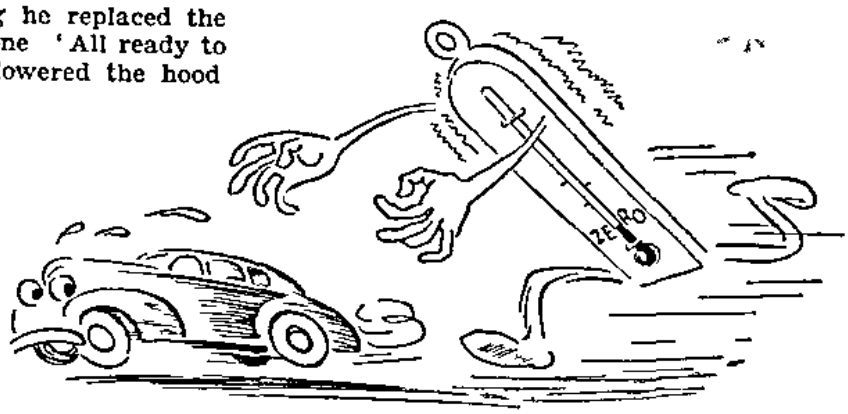
'I guess I do,' Ez said doubtfully, and bit off a modest inch of coal-black plug 'Well, I better be gettin along an'—hey, there's some guy who s in a *real* hurry!'

It certainly sounded that way From outside came repeated squawks of a raucous horn 'Let him in, Harry,' Gus directed the grease monkey "If you don t, he ll knock our doors down '

Harry opened the doors He had to step lively to get out of the way of a sedan which shot into the shop and came to a jarring stop Out of it leaped old Silas Barnstable, looking even more like a bantam rooster than usual in the ancient seal-skin driving cap he was wearing 'Do something quick!' the little retired farmer squealed "My motor's red hot and my radiator's b iling over!"

Gus raised the hood and cautiously unscrewed the radiator cap, releasing a cloud of steam 'All right—you can switch off your engine," he told Barnstable You ran it close, all right! I ll bet there isn't more than a cupful of water left in your cooling system"

"You fellers have cheated me!' old Silas yelped 'That Joe Clark told me I ought to fill up my car with a lot of high-priced antifreeze, an' I was fool enough to do it



Now look what happens the first cold day we have My rad ator all froze up busted likely

No your radiator isn t frozen and it sn t busted Gus reassured him But your hose is leaking so badly that your cooling system is darned near dry

I z Zacharias began to laugh—and when big Ez laughs the walls shake Tell the whole story Mr Barnstable he scoffed I was in here when Joe Clark argued you into buying that ant freeze and I heard him warn you that your hose was so rotten that you d probably lose most of it That s my d e a o f cock eyed economy—wasting pretty near five dol lars worth of anti freeze to save a quar ter for a new hose

Old S las glared at Ez and turned to Gus I m depending on you to do the square th ng about this he wheedled I ain t had any use out of that antifreeze so it would be only fair for you to replace it without charging me anything But I ain t asking you to do that—make it half price for the new antifreeze and fill her up

Gus laughed No smoke Mr Barn stable he said good naturedly but very firmly Joe warned you that your hose was rotten You didn t take his advice to put in new ones so you ll have to stand the loss I ll install new hose and put in a fresh filling of antifreeze if you want me to but you ll find both items charged on your b ll at our regular prices

You re the hardest man to do business with I ve ever run up against in all my born days S las growled No give and take spirit at all All right—have it your way I ll be back for my car this afternoon

Serves the old skinflint right Ez ob served after Silas had left He s so mean he—

He can t help being a penny pincher He was born that way Gus said And after all the grief he gets into by being so tight is pretty much the same as the grief that a lot of other car owners bring down on themselves through plain carelessness He s not the only man in this town who makes his winter driving hard instead of easy

Ez settled himself comfortably on the end of Gus s workbench How come? he wanted to know

The first thing you ve got to have to make winter driving easy Gus explained is a cooling system that is tight as a drum Antifreeze no matter what brand of it you use costs money and there s no sense in pouring it into your radiator and then al lowing it to leak out That s bone headed waste And besides that it is mighty likely to result in serious damage to your engine Before cold weather starts you should have your cooling system checked to make cer tain that your rad ator doesn t leak that your hoses are good and their connections tight that the cylinder head gasket is tight and that your pump shaft is tightly packed

After you have made sure that your cooling system is tight you should make just as sure that your radiator is clean—that it isn t clogged or half-clogged with rust sludge scale or sedi ment You can do that by flushing it out with a ten cent can of the same sort of prepared noncaustic powder that s sold for keeping bathroom drains clear—you can buy it in any grocery store and in most garages Run your engine until the water in the system is warm Then pour the powder into the radiator and run your engine for another fifteen minutes Then drain the radiator and flush it out once with warm water Less than a half hour s job—and when you have done it you know that your radiator is clean

I ve heard a lot of arguments about anti freeze mixtures Ez observed What s the best one Gus?

So far as I know there isn t any best one Gus said That s why we sell sev eral of em The more expensive ones are made of about ninety seven percent ethy lene glycol with added ingredients which protect the cooling system against rust and corrosion They don t evaporate or boil away and you can drain them out of your radiator in the spring allow the d rt to settle out of them during the summer and then use them again the next winter

If your cooling system is tight and you use the proportion of ant freeze to water recommended by the manufacturer it will give your car absolute protection Only the water in the radiator will evaporate and if all your winter driving is short trips so l ttle of the water will evaporate that it won t need to be added to until spring It s a good idea (Continued on page 237)

GUS SAYS

The dr vers who put off gett ng their cars ready for w nter are the ones who help me pay my in come tax so I really shouldn t k ck But I hate to see good mach nery ru ned and noth ng w ll ruin an eng ne block l ke ice Get busy and check up on your antifreeze!

HOME *and* WORKSHOP

Heating at Lower Cost • Wall Uni

Modernize a Room • Arc Solderin



See Pa
186

Saving Money on

ARE YOU STOKING THE FURNACE WITH DOLLAR BILLS? HERE ARE SIMPLE WAYS TO SLASH YOUR FUEL COSTS

By IRA KUCHLER
Consu ng A ch tect

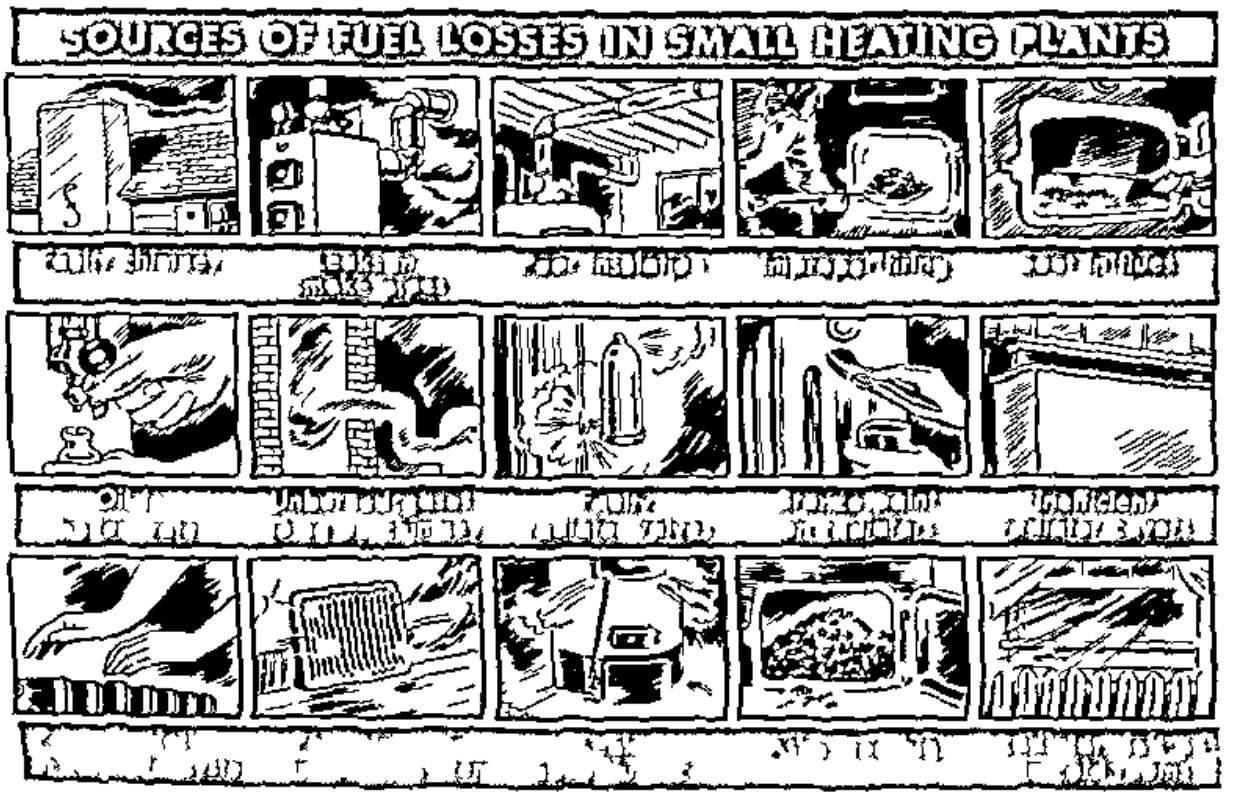
DID last year s fuel bill upset your budget? Unnecessary heat losses in the heating system may have been responsible and a few minor repairs or changes will perhaps result in reducing the heating costs considerably

Start with a factor common to all steam and hot water systems—the paint on the rad ators If the paint is aluminum or gold bronze the rad ator is losing upwards of five percent of its radiated heat by reflection back into the metal Several coats of a good eggshell or flat finish linseed oil paint chosen to harmonize with the room and ap plied thin to a warm radiator will stra ght way knock a b t out of your fuel costs It isn t necessary to remove the old finish

If the radiator covers are badly designed closing in the heat beneath them they may waste as much as thirty percent of the heat Well designed covers permit a free circula tion of heated air

For efficient radiation all air valves on radiators must function properly If the small hole in the cap is clogged up a p n will open it If the valve doesn't work even when clean yet there is good steam pres sure try turning it to a 45 deg angle or even upside down If this fails the valve should be removed and soaked in gasoline or boiling vinegar

Are your boiler and cellar piping suffi ciently insulated or are you burning up extra fuel and making a hothouse of the cellar? The extent to which insulation is needed depends upon the system and the immediate conditions In a hot water sys tem it is well to cover at least the boiler and the pipes through which water is dis tributed to the radiators Covering the return p pes is also advisable so that the water returns with minimum heat loss In vacuum and vapor heating systems it is better to leave the return pipes bare to

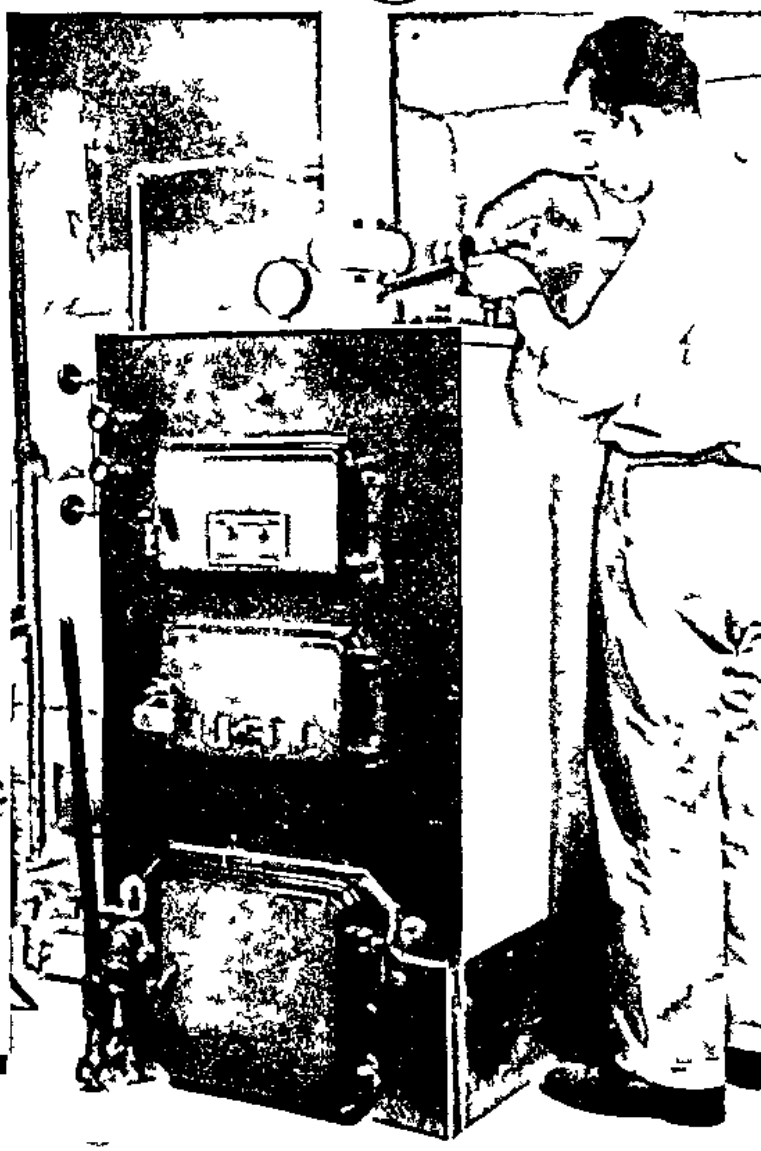


Home Heating

aid in condensing any remaining steam that has escaped into them

If the boiler is not already insulated it should be covered with two coats of asbestos cement the first coat being applied 1" thick and the second $\frac{1}{2}$" thick If pieces of insulation have broken away the *bare spots should be filled with this* cement. Pipes may be coated with cement in two ¼ coats or special air cell asbestos coverings may be wrapped around them

Leaky pipe joints and defective pipes in all systems are another cause of heat loss Inspect the piping of your hot air system and the smoke pipe to the chimney Also examine the boiler for air leaks Note if the base of the boiler has been properly cemented and if the





Joints in the hot air heating pipes can be made tight and secure by pasting on asbestos paper





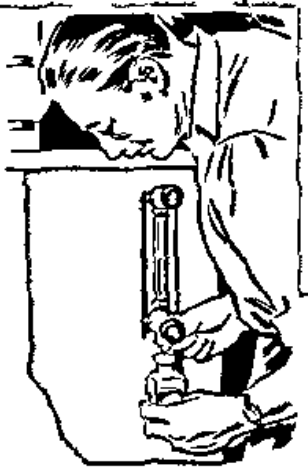
Inspecting a radiator valve Right cleaning the surfaces of flues and fire box Above at right adjusting the damper



Below if nsulat on breaks awav f om the bo ler patch up the hole w th as bestos cement Otherw se some heat w ll be d ss pated into the cellar



Above nsulate cellar p p ng w th a r cell jacket ng ma ter al R ght draw ng off bo ler water to test for o l



space between sections and base has been well sealed with boiler putty

Is there oil in the boiler water of your hot water or steam plant? Oil costs money because of the added fuel required for the heat to break down the greater surface tension produced You can find out by drawing off a little of the boiler water in a small bottle from a cock under the gauge glass and shaking it up If bubbles in the water rise quickly to the top and disappear there is no oil in the water If however the bubbles remain suspended there is oil which must be removed. This may be accomplished either by having a plumber blow the boiler or by adding a prepared compound to the water which combines with the oil and allows it to be drained out.

For maximum efficiency boiler water should be changed with discretion Due to the fact that air is constantly being driven out in hot water boilers and in addition is being distilled in the case of steam boilers stale water is generally better than fresh water It is less corrosive and holds its heat better Water therefore should be left in the boiler until the amount of sediment makes a change seem advisable

The idea of banking the fire at night, even with coal fires has been routed as uneconomical It is cheaper experts have found to reduce the home temperature only a matter of 10 deg or so at night than to let the temperature drop very low and then have to supercharge the fire in the morning to bring the heat up to normal again In heating plants controlled by clock thermostats maintain a 70-deg temperature between, say 7 in the morning and 11 at night and a night temperature of about 60 deg

Radiators left turned on in rooms that are wide open to the cold are another source of fuel waste as they lower the heat in the entire system and force the furnace to increased output

In the economical adjustment of the fire in gas and oil burners so much delicate and intricate mechanism is involved that the average home owner must rely for this up on the technical expert. Unless something seems seriously wrong burners need be cleaned checked and adjusted only about once a year

In the hand fired coal furnace however careful checking and attention may pile up savings that run up to forty percent of a careless home owner s bill. Begin your checking with the chimney as consistently poor combustion is due to an improper draft.

Often a chimney is too large or too small or its efficiency is cut by a chimney cap or by a neighboring gable or high building that blocks it. Perhaps its draft is weakened by leaks in the brickwork or by protruding tile The inside may be inspected

by holding a small mirror n the smoke pipe opening If the draft is found to be too strong it may be cut down by partly closing the smoke pipe damper At the same time you may economize by us ng smaller coal If the draft is too weak and the fault can not be corrected then for good combustion you must keep the coal bed th nner by fir ing more often and you must use larger coal to permit air to get through it

For greatest comfort and economy the coal fire should burn as uniformly as pos sible As a rule the fire box should be kept full and t s better to put on coal enough to last for half a day than to feed it in dribbles Shake the grates no more than necessary to permit a flow of air through the fire When the weather is mild the fire should slumber on a bed of ashes from 2 to 6 deep As t gets colder shake down the ashes for greater draft and to give more space for coal above Clean out ashes every day as ashes banked up under the grate shut off air and may cause the grate bars to warp

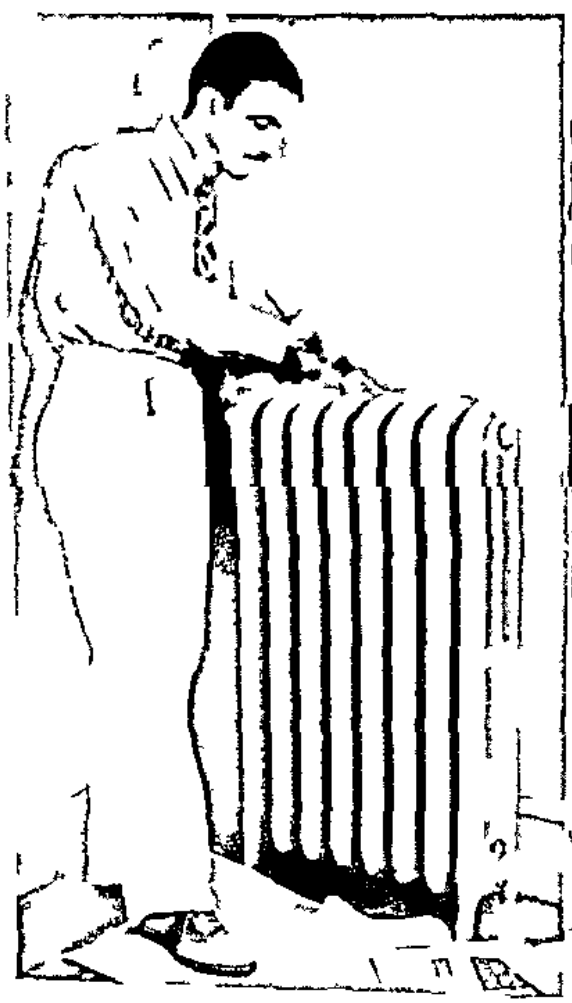
Control of the rate of burn ng of your fur nace fire should always be by means of the draft damper at the bottom of the furnace and the check damper in the smoke pipe

In steam plants these dampers are con trolled automat cally by means of a regula tor which operates in response to the steam pressure and is adjusted by a sl d ng weight Experience best teaches where to keep the weights for various weather cond t ons Un der no circumstances should the fire door be left open as a check on the draft

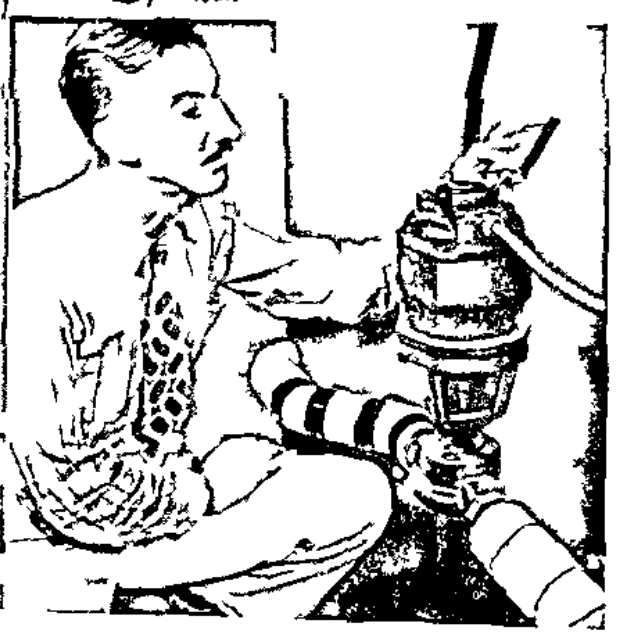
When firing at night in very cold weather shake down the grate unt l t is covered with red hot coals push some of the coals up in a pile in the back then fill the fire pot w th coal leaving a red spot in the back glow ing through Th s full pot and the deep fire will burn the least coal allowing plenty for the night and some for the early morn ng

The red spot s the secret of additional saving It burns the surface gases that would otherwise go up the ch mney

Clean furnace flues constitute a final dras tic source of fuel economy Dust and soot on these flues insulate them from the fire as effectively as an asbestos coat ng Clean ng the flues with a w re brush or scraper every month is none too much



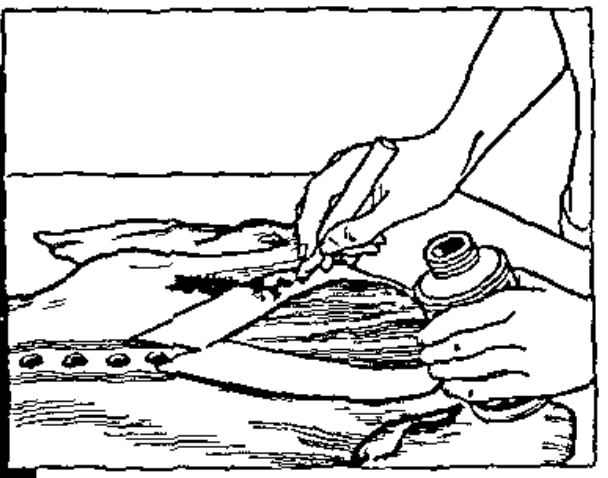




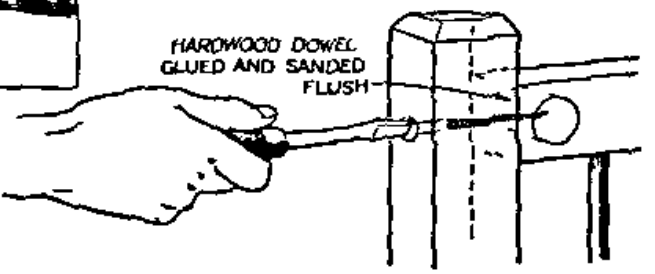
Left repa ng c acks n smoke p pe and ch m ney f xtu es At far left g ve the rad ato s a good coat of l nseed o l pa nt to match the woodwo k n the oom Below an automat c elect c c culat ng pump fo a hot water system saves fuel by nsu ng mo e un fo m d st but on of heat

Keeping the Home





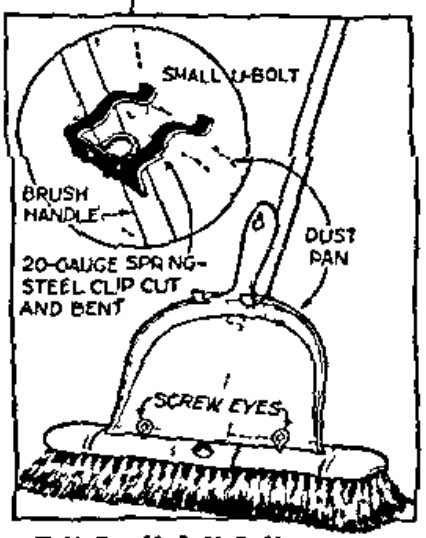
TO REMOVE SPOTS FROM SILKS and other fine fabrics, apply the dry cleaning fluid with a stick of white chalk The chalk aids in loosening any foreign matter and absorbs the stain When dry dust off the chalk



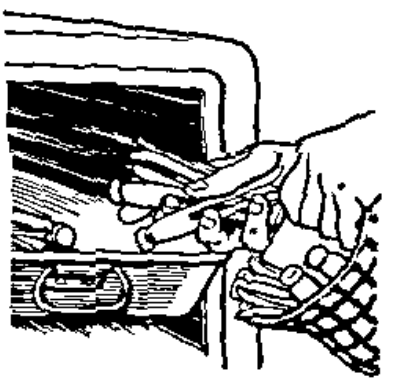


A MAN WITH A LARGE FAMILY is apt to find the baby crib has loose joints after it is dismantled and assembled several times This can be overcome by inserting a hardwood dowel to act as an anchor for the end of the screw Glue the dowel in place and sand it flush Then touch up the spot with suitable paint

SHORT-STEMMED ROSES can be arranged in a vase with long stemmed flowers by using straws Insert the stems in the straws then trim to the desired length

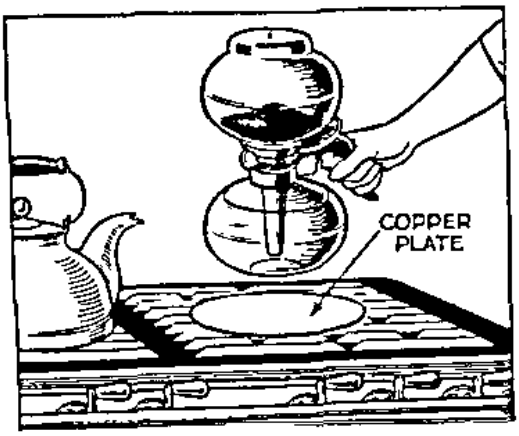


THE DUSTPAN IS ALWAYS handy if it is attached to the floor brush as at the right Two screw eyes and a spring steel clip hold it tightly against the handle



CLOTHESPINS HEATED IN the oven for a few minutes will help keep your hands from getting numb when hanging up wet wash outside during the winter

Shipshape



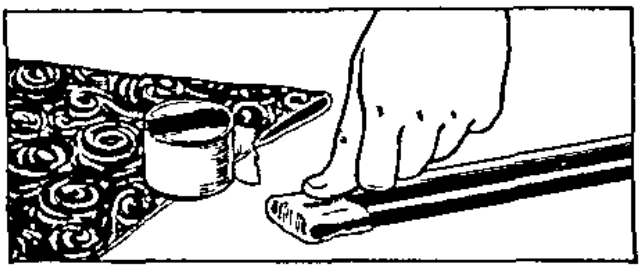
A 1/32" COPPER PLATE 9" in diam eter placed between gas flame and an all glass coffee brewer prevents the lat ter from cracking if the flame is too high



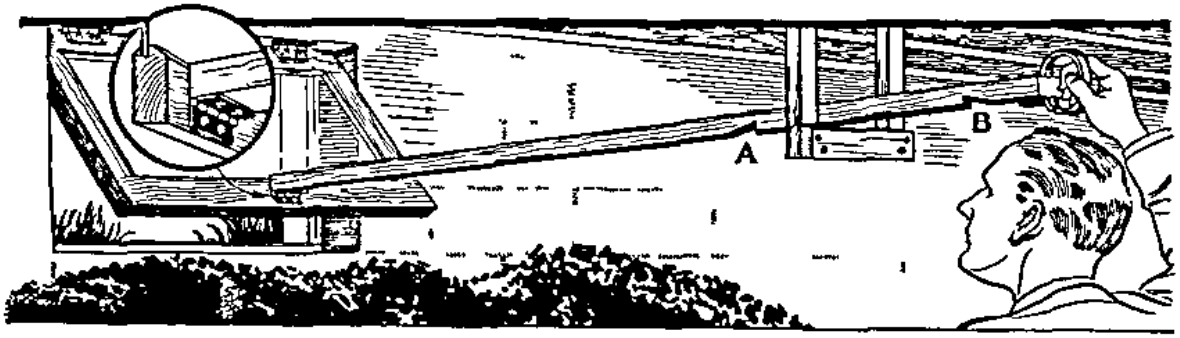
THIS ATTRACTIVE HANGING BASKET is made from an old auto headlamp and some chain or light rope Remove the lens reflector and wiring from the lamp and replace the rim Drill three holes around the rim, equally spaced for fastening the chain or cord



IF THE HOT WATER BAG LEAKS you can still use the bag by filling it with hot salt Heat the salt in a pan and pour it into the bag w th the aid of a small funnel



TO PREVENT THE END of a curtain rod from catching in the material when pushed through the hem, cover the end with a strip of cellulose tape

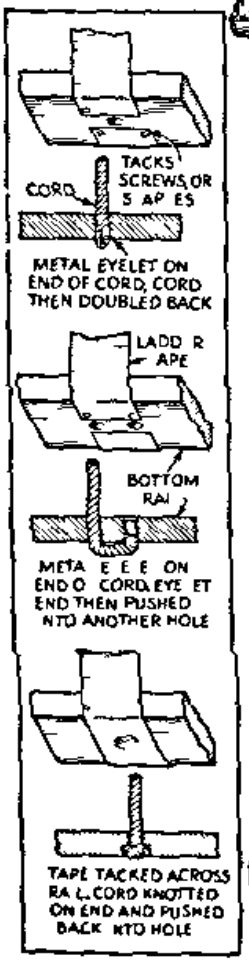


REMOTE CONTROL FOR WINDOW You don t have to crawl over the coal to close the coal bin window with this arrangement Cut two notches in the long extension arm so that notch A' holds the window open and notch B keeps it tightly shut Fasten the two uprights to the floor joists above

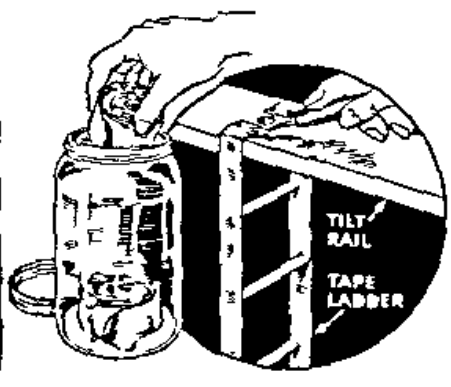
Cleaning



F st step n clean ng Venet an bl nds s to take out the l ft co d wh ch may be attached to the bottom ra l by one of the methods at the left Below the tapes a e unfastened and put n a jar of d y clean ng flu d



By
MEL MENDEL



VENETIAN blinds should be taken apart in order to clean them properly Daily dust ing and wiping may remove surface dirt but after blinds have hung awhile nothing will make them look like new but a thorough renovation

To take a Venetian blind apart first tip up the bottom rail. If the lift cord (the cord that runs up through the blind) is just doubled back upon itself and jammed into a small hole pull the cord out with small pliers If the lift cord is con cealed under the ladder tape (the woven tape which supports the slats) which has been tacked across the bottom ra l slightly raise one edge of the tape and pull out the lift cord and untie the knot at the end Do this to both cords then pull the cords up through the slats With the cords removed the slats can easily be taken out.

Dust the slats with a dry cloth Then lay each slat on a flat surface longer than the slat (to avoid breakage) and wipe with a cloth dipped in soapy water Go over the entire surface first on one side then the other Wipe both sides with a clean cloth wrung out in cold water Finally rub with a dry cloth The work can be done faster if the slats are cleaned on old newspapers which can easily be discarded as they get dirty

In cleaning the slats a fly spot or other blemish may be encoun tered that cannot be removed mere ly by going over it with a soapy cloth In that case place a pinch of granulated soap powder on the spot and rub energetically It will generally give way

Furniture polish sometimes proves of value in removing blemishes and it will also make the slats glossier and easier to dust.

If you have light colored ladder tapes to clean an easy way is to use an ordinary quart Mason jar They must be dry cleaned because they are cotton and shrink very easily

Venetian Blinds

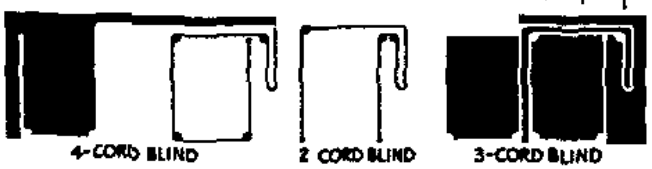
To remove the tapes first take the slats out of the blind as outlined before Then remove the small gimp tacks staples or screws that hold the tape to the bottom rail and the tilt rail After the tapes are free, carefully measure *their length with* the tapes stretched tight. Roll the tapes up and place them in the glass jar About two tapes can be accommodated at a time Fill the jar with dry-cleaning fluid screw on a cover shake the jar well and let it stand for a few minutes Shake again and remove the tapes Measure the tapes for length and dry them while stretched to that length

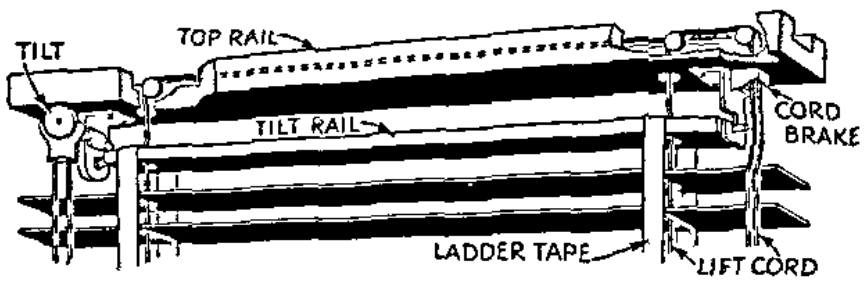
If you wish to change the color scheme the tapes and cords can be dyed by a local cleaning and dyeing firm or with household dyes at home If new cords and tapes are purchased for dyeing, be sure to add enough to allow for shrinkage When the old tapes are used measure them first, *then stretch them as much as possible* before dry-cleaning them As soon as the tape and cord have been dyed and rinsed properly, stretch the tape to the proper length and dry it while stretched

In case you have a large number of blinds to be cleaned and they are of a type readily removed from the windows it will pay to fasten two 4" angle brackets on the basement wall or in the garage to facilitate taking the blinds apart. Place them so that the longest blind will hang about 4" off the floor

In restringing the cleaned blinds, it is somewhat confusing to remember the path of the lift cords This is indicated, however, *for* both narrow and wide blinds in one of the accompanying diagrams You will undoubtedly find that all such problems solve themselves once you start work



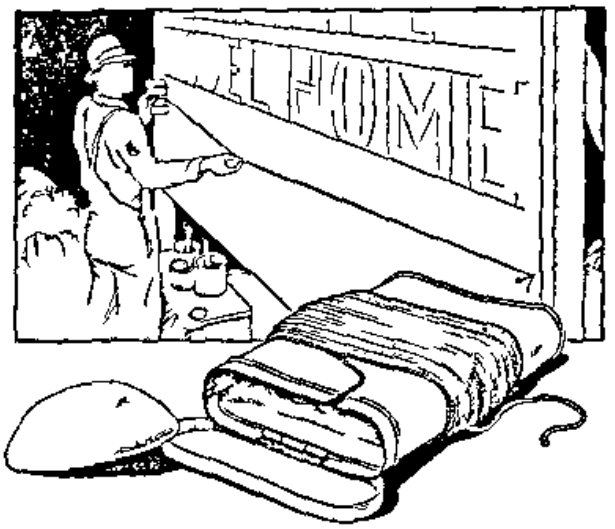




Above each slat is wiped with a cloth dipped in soapy water, also three arrangements of lift cords and pulleys Left blind assembly

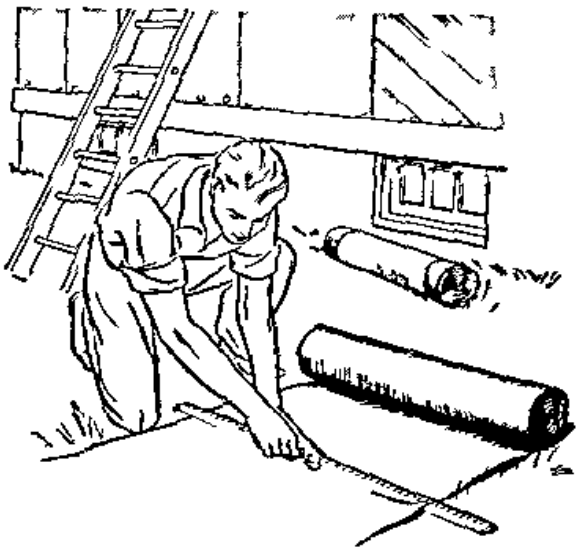
Metallic Insulating Paper Used for Making Light Reflectors

EXCELLENT light reflectors for various purposes may be made inexpensively from the type of insulating building paper that consists of paper faced on both sides with aluminum foil One large store has been using it at a *considerable saving in the* power bill because it reflects *more* light than ordinary reflectors It is also possible to use this material or plain aluminum foil for making shades over workbenches It has even been used successfully in salvaging old auto reflectors —KENNETH GRAY



Pocket Tobacco Can Holds Painter's Line and Chalk

AS A REEL for his chalk line one sign painter finds an empty tobacco can serves the purpose better than a piece of board A slot cut into the top of the can holds the knotted end of the line The can also acts as a container for the usual half spheres of chalk Masons who also use chalk lines will find this hint equally helpful



How to Score Building Paper So It Can Be Torn Straight

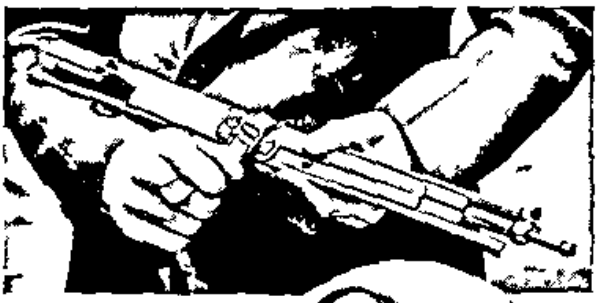
A TOOTHED tracing wheel of the type used by dressmakers boat builders and others is a good tool to score light roofing or building paper so that it may be torn

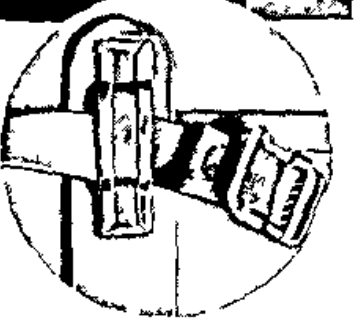
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HIGH-GRADE furnace cement in putty form can be used to repair cracked fire bricks if the bricks are otherwise intact.—L. J

Strap Keeps a Music Stand in One Compact Bundle

A FOLDING music stand is unhandy to carry without a case yet a case adds to the bulk and is just one more item to keep track of One musician solved this problem by soldering a piece of sheet metal as shown to the back of the upper end of the middle part of the desk This loop holds a short web strap in place When the stand is folded the strap is buckled around the parts and keeps them together with practically no increase in bulk —JOHN M AVERY

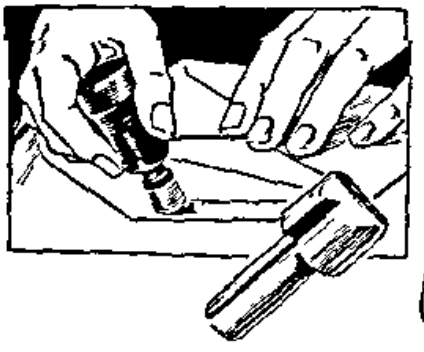


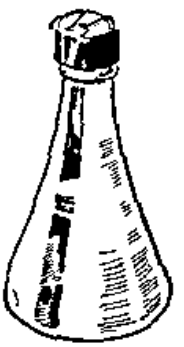


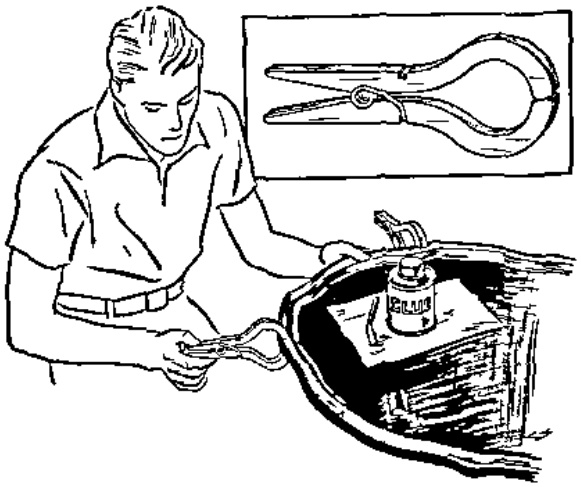
The two parts of a music stand can be kept together when a case is not used by means of a short strap This is held by a metal loop as shown in the circle

Envelope-Sealing Moisteners Made from Small Bottles

TWO quickly made sealers for moistening ordinary envelopes are illustrated One is made from a small bottle with a composition screw cap the other from a mucilage bottle for which a special stopper is whittled from a scrap of wood The width and depth of the V slot in the wooden stopper are best found by experiment The bottles may be painted but not the bottom because it is used to smooth down the envelope flaps —W E. H.







Clamps for Uneven Surfaces

SPRING wooden clothespins which are often used as small clamps, can be considerably improved for certain types of work by discarding all but the springs and cutting new jaws from ½" hardwood to the shape shown above These jaws are much better for gripping uneven surfaces because there is no twist or side thrust to throw the freshly glued work out of line as when ordinary clothespins are used —L A L

Soft Rubber Thumb-Tack Cup



THUMB tacks are easily picked out of a cup made from half a rubber ball as shown It is attached to the drawing board in any convenient place by means of a single long-pointed thumb tack —E H

Shellac and Wax Preserve Much-Used Bookbindings

TO KEEP bookbindings in good condition, a public library uses a simple method that is equally suitable in the home, particularly for books kept in the workshop or otherwise subjected to hard wear Merely brush on a coat of white shellac, allow it to dry thoroughly, and then apply paste furniture or auto wax Rub the wax to a high polish This finish resists constant handling and moisture and is easily cleaned —E B



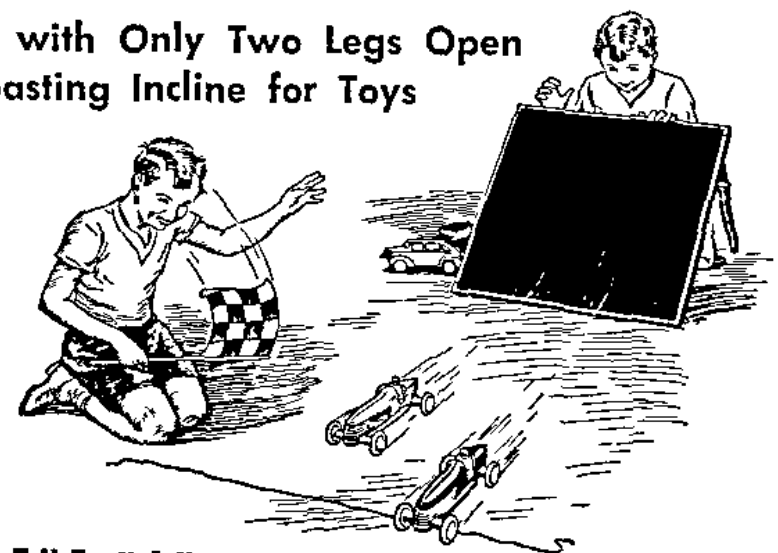
Furniture or auto wax is applied over a coat of white shellac to protect the book covers from wear

Cleaning Separator Bearings

WHEN a cream separator turns hard and stops with a droning chug at a time when you are too busy to give it immediate thorough attention, try this little trick Drain the gear case and flush with kerosene Then refill with one part penetrating oil and two parts of the usual oil This will often free the bearings of residue and restore the machine's efficiency —ROYCE M ROATH

Folding Card Table with Only Two Legs Open Provides a Coasting Incline for Toys

IF ONLY two of its legs are opened, a card table will provide a suitable incline upon which children may operate small toy autos and trucks as speedy coasters



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BEFORE being repainted, rough textured or plastic-paint walls can be improved by cutting down the high points of the old paint with a portable disk sander

NEW IDEAS FOR YOUR CHRISTMAS



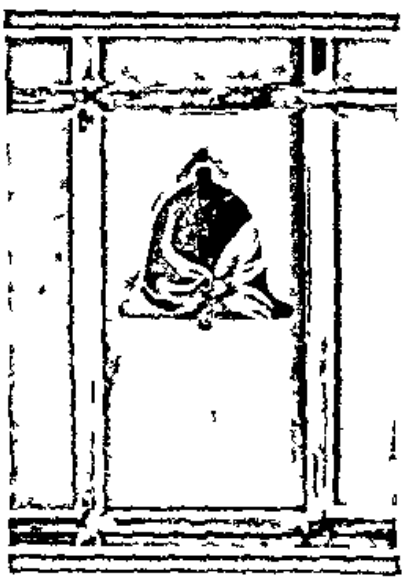
Christmas cards are displayed to better advantage when hung on a plywood tree Above attaching the slotted trunk

By WALTER E. BURTON

MANY unusual but inexpensive decorations can be prepared during the next few weeks for creating a holiday atmosphere in your home this Christmas

For example, when the Christmas cards begin to come in, do you like most people, toss them helter-skelter into a box? It's much more fun to hang them on a decorative wooden Christmas tree like that illustrated above Cut the tree from ¼" plywood, make a trunk from a length of dowel rod, broom handle, or any available round stick, and cut a star-shaped base from 3/16" or ¼" plywood The tree shown is 26" from base to tip and 18½" wide, the trunk is 1" in diameter and 4" long, and the base is a six pointed star laid out in a circle 9" in diameter

Paint the tree bright green or red to harmonize with other gay Christmas decorations Drive small brass escutcheon pins (or ordinary pins cut to ⅜" long) into the tree so that the heads project ⅛". To hang a card up, slip a small paper clip over the upper edge at the center and let it project a little, then place the loop of the clip over the head of a pin Circles of brightly colored paper or paint will make the tree more attractive before the cards begin coming in and when it is only partly filled with the greetings



How a frosted window appears with a bell shaped film and decoration

Christmas bells and wreaths hung behind windows or glass doors are sometimes wholly or partially obscured by the steaming or frosting of the glass This is especially likely to happen while the Christmas dinner is being cooked. To keep the glass clear, you can use to advantage the transparent

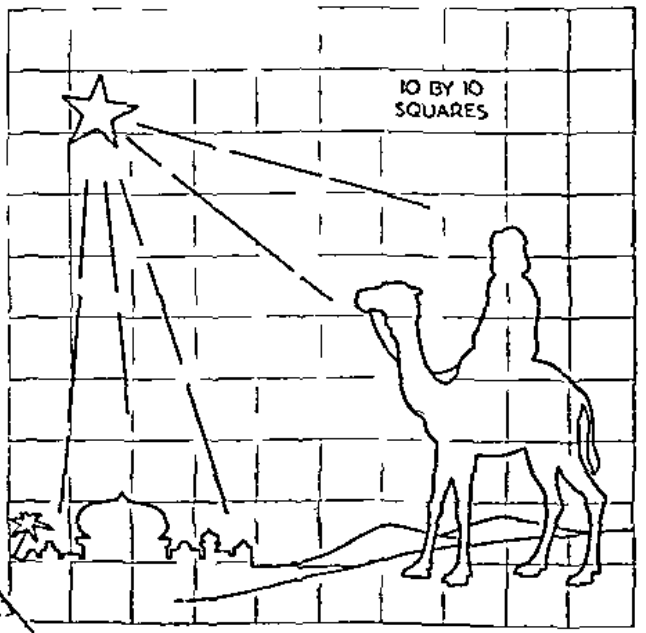
DECORATIONS

films sold for cementing on automobile windows These films are commonly sold in the form of kits consisting of several sheets of the transparent material a can of cement rubber squeegee and a piece of viscose sponge to mop up excess adhesive When the film is applied to glass frost and water vapor will not condense on it except at very low temperatures

Novel decorations for windows are made by cutting the same film into such Christmas shapes as bells and stars To apply the cut outs dip them into the adhesive solution supplied with the film and squeegee them to the glass When the window becomes steamy or frost forms the designs will appear as transparent areas The film is easy to remove later on It merely requires to be moistened

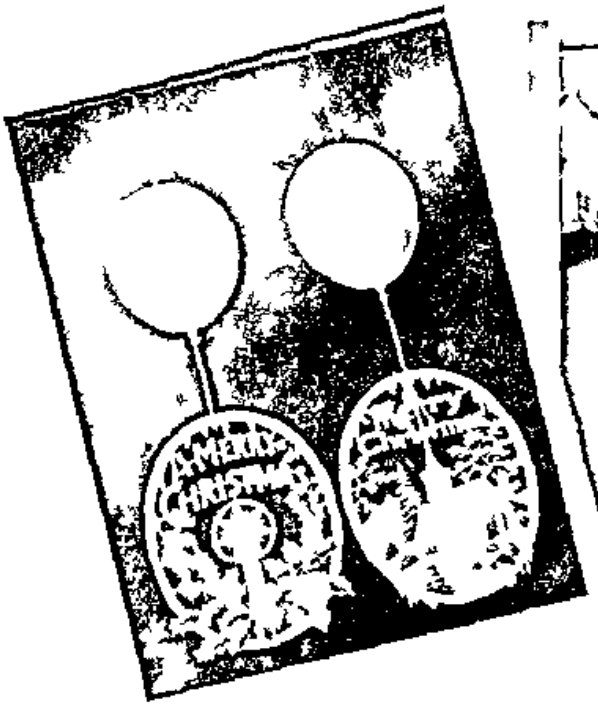
Another type of decoration visible by day or night, can be made from an opaque dark colored window shade Sketch an appropriate design on a piece of paper large enough to cover the lower half of the window Fasten the drawing to the shade with adhesive tape and use a large needle to punch holes about $\frac{1}{8}$" apart, outlining the design* Then remove the paper When the shade is hung over a window in the daytime the design will be seen from

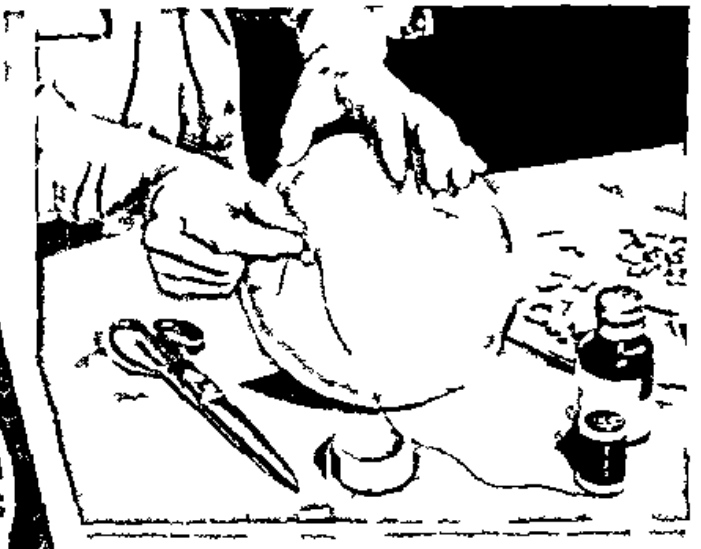
*A variety of Christmas designs to suit almost any project from a huge roof top silhouette to a small place card are given on a page of drawings following this article





When enlarged this design is transferred to a dark window shade by making perforations





Fasten ng th ead to a toy balloon to be used n a balloon barrage for support ng Chr st mas deco at ons l ke those shown at the left

inside the room as a series of bright points of l ght At night a floor lamp with either a translucent shade or none at all is placed behind the shade so that the des gn will be visible outdoors

A holiday balloon barrage is an unusual way of supporting paper bells cut out de signs and other decorations that can be suspended from a ce ling or archway In flate some spherical toy balloons and at a point on top opposite the stem attach a length of thread to each To do this coat a small area with rubber cement let it dry for a few minutes then lay the thread across it. Cut a small str p of elec trician s rubber tape or the sheet rubber material made for patching automob le in ner tubes and apply the tacky s de to the cement covered spot across the thread Tie the thread around the strip

Use the thread to suspend the balloon from the ceiling or in an opening between rooms Tie one end of a length of Christmas pack age cord to the balloon stem and the other end to the decoration If the thread is of such color that it blends with the background it will look as if the balloon alone is supporting the dec oration

Sticking Christmas seals on woodwork painted walls and other surfaces is a simple way of brightening the home for the holidays The seals can be ar ranged in interesting patterns However if you mo sten the gummed adhesive on the seals to attach them you will have difficulty removing them later so use rubber cement. The seals then can be peeled off later on without trouble Do not however attempt to cement them to wall paper they would be difficult to remove and the cement might leave marks



Ch stmas seals form colorful spots f app ed to woodwork Use rubber cement so they can be removed later on w thout leav ng any uns ghtly ma ks

Did you ever think of making special Christmas book ends for the holiday season? One possible ar rangement using cardboard cut outs is shown Obtain or draw on paper a picture of Santa Claus descending a chimney with his pack Paste th s on a sheet of stiff cardboard and cut out the figure leaving a few inches of extra stock at the bottom Tint the edges with water color

Make the chimney in two sections from the same cardboard Cover the lower section with red paper ruled with black ink in imitation of brickwork and the up per section or cap with pa per colored dark blue or some other appropriate hue Glue the cut out figure to the back of the assembled chimney and then glue a piece of cardboard to the

bottom so it will extend back under two or three books when the book end is in place Give the chimney cap a coat of clear brushing lacquer and spread on tinsel or glitter

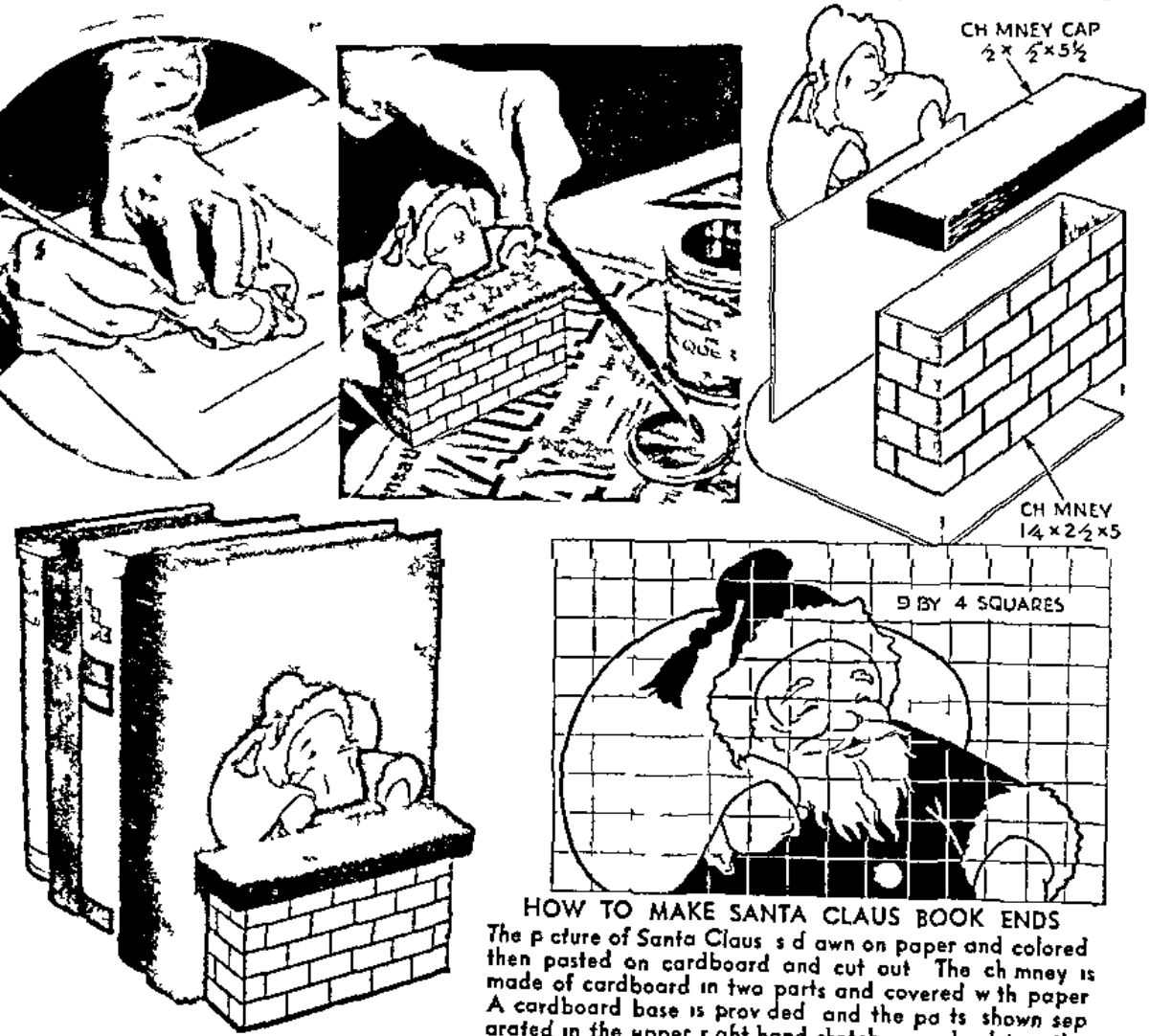
Cardboard shapes for Christmas decorations can be cut without tedious labor by using a sewing machine in which the needle has been replaced by a small chisel like cutter *It is possible to purchase such cutting* bits in some large well stocked hardware stores but it is easy enough to make one by grinding a broken needle to form a thin flat blade with a beveled cutting end Set the sewing machine for a short stitch Such an arrangement will also cut very thin plywood and other soft materials

By using chemicals you can add color to Christmas candles and fireplace flames Sodium compounds give the most brilliant effect—a golden yellow To color a candle flame simply place a small amount of baking soda at the base of the wick This will last for a long time Washing soda or photographer s sodium carbonate or sulphite can be used as well

For a fireplace newspapers can be soaked in a solution of soda rolled tightly into sticks and put aside to dry or pieces of wood can be soaked in the solution and dried A few such pieces tossed on the fire will produce the color

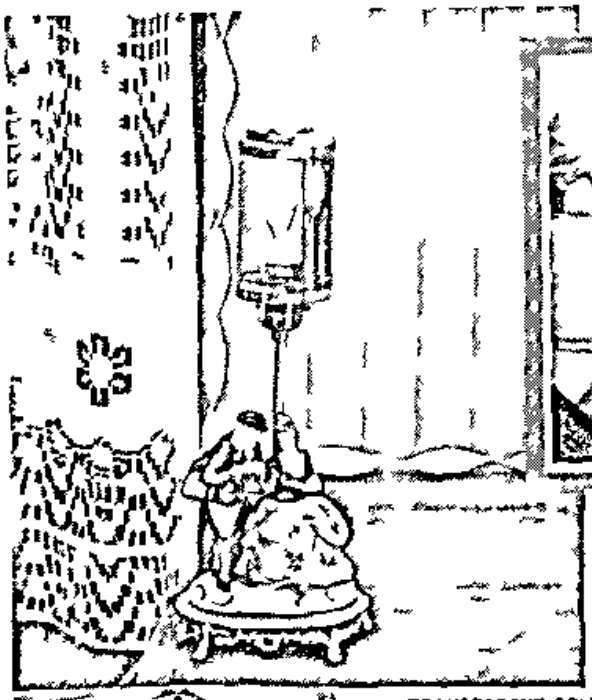
Although sodium flames are most brilliant other chemicals can be used to produce *different colors as follows Potassium com* pounds violet copper compounds other than the halides emerald green calcium compounds yellowish red strontium compounds scarlet The yellow flame of the fire will however often mask the weaker colors

With two easily made color cylinders you can rig up an attractive window display of ever changing colored light Obtain some colored gelatin like that used over theatrical spotlights and store window lighting units (Don t use celluloid or inflammable materials) Cut three rectangular pieces for each cylinder Fasten blue red and yellow pieces (or some other combination) edge to edge to form a cylinder about $3\frac{1}{4}$"



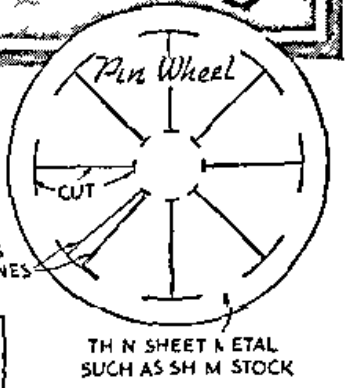
HOW TO MAKE SANTA CLAUS BOOK ENDS

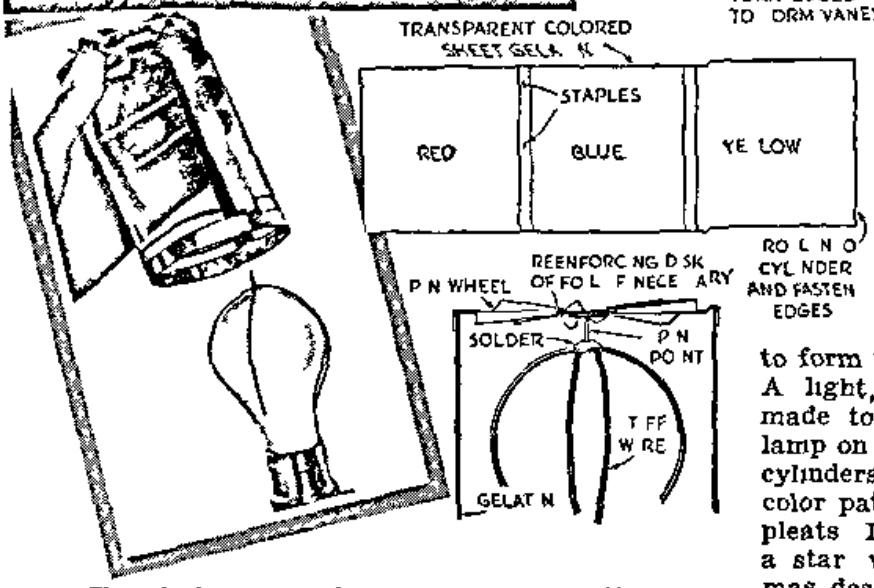
The p cture of Santa Claus s d awn on paper and colored then pasted on cardboard and cut out The ch mney is made of cardboard in two parts and covered w th paper A cardboard base is prov ded and the pa ts shown sep arated in the upper r ght hand sketch a e glued together





A p n wheel made of heavy fo l or very th n metal keeps the colo cyl nder n mot on





The cyl nder s p voted on a p n po nt ove a 40 or 60 watt lamp Hot a r ses and causes t to revolve

These revolving col or screens can be dis played effectively in front of a window Cover the lower half of the window with thin white paper folded to form vertical accordion pleats A light, wooden frame can be made to hold the paper Set a lamp on either side and start the cylinders A constantly changing color pattern will be seen on the pleats If desired you can fasten a star wreath or other Christ mas des gn in the center of the paper to act as a s lhouette

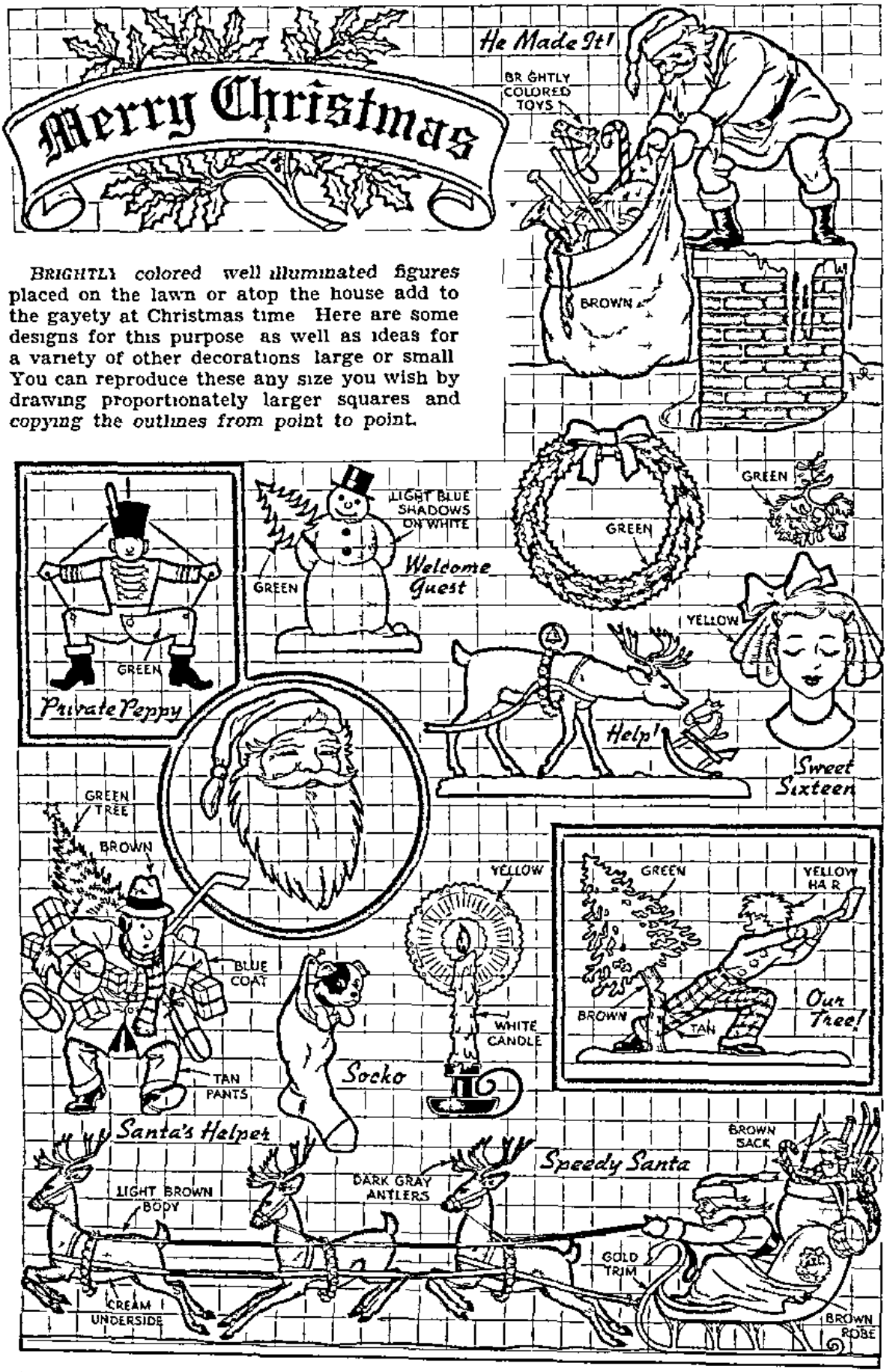
in diameter and 5 long Use a stapling ma chine or needle and thread

Over the upper ends of the cyl nders fas ten p n wheels made from metal fo l such as that used around photo film packages and b nd decorative strips of tin fo l around the lower ends

The p n wheels are merely disks with ra dial cuts as shown Bend the segments to form blades against wh ch hot air currents rising about the lamp will strike Make a wire frame for each lamp which should be 40 or 60 watts and at the top solder a short length of a pin point up When the cyl nders are balanced very carefully on these points they will rotate as long as the lamps are burning although it takes a minute or so for them to start

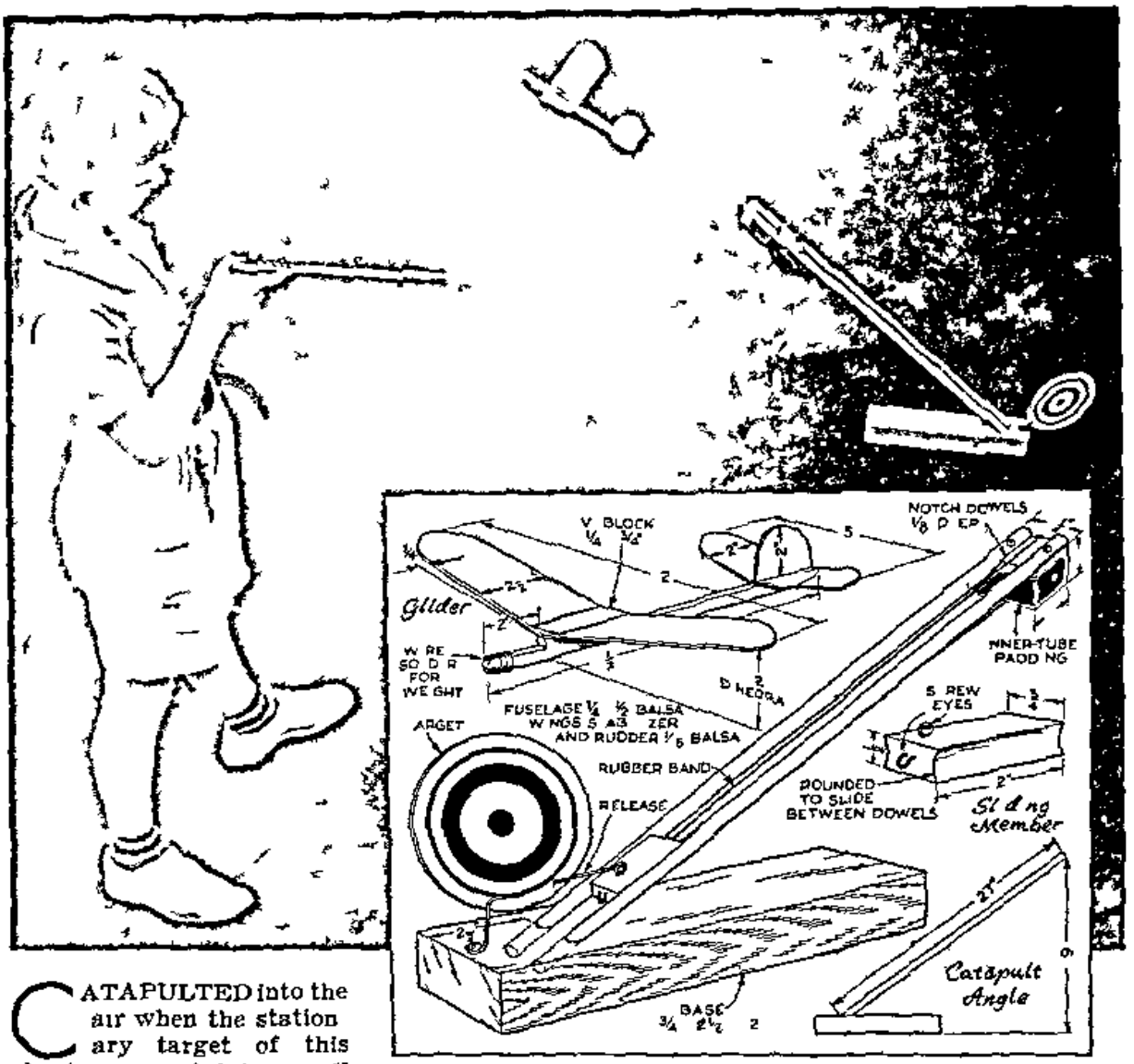


Newspape s f soaked n wash ng soda solut on and d ed p oduce br ll ant colo s n the f replace


Merry Christmas
He Made It!
BRIGHTLY COLORED TOYS
BROWN
BRIGHTLY colored well illuminated figures placed on the lawn or atop the house add to the gayety at Christmas time Here are some designs for this purpose as well as ideas for a variety of other decorations large or small You can reproduce these any size you wish by drawing proportionately larger squares and copying the outlines from point to point.
GREEN
GREEN
GREEN
LIGHT BLUE SHADOWS ON WHITE
Welcome Guest
Private Peppy
YELLOW
Help!
Sweet Sixteen
GREEN TREE
BROWN
BLUE COAT
TAN PANTS
YELLOW
WHITE CANDLE
Socko
GREEN
YELLOW HAIR
BROWN
TAN
Our Tree!
Santa's Helper
LIGHT BROWN BODY
CREAM UNDERSIDE
DARK GRAY ANTLERS
Speedy Santa
BROWN SACK
GOLD TRIM
BROWN ROBE

Toy Antiaircraft Gun

LAUNCHES GLIDER, THEN SHOOTS IT DOWN

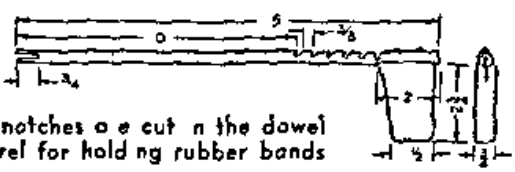


CATAPULTED into the air when the stationary target of this shooting game is hit a small glider flies up to provide a moving target for the remaining shots on the six round rubber band gun. Novel as this game is it can be easily constructed from scrap materials and will furnish many hours of enjoyment for children.

The catapult is built of two dowel rods set at an angle in a wood base. A cardboard target wired as shown releases a sliding member that launches the glider. The small stop block at the top of the catapult is padded with rubber strips.

A dowel attached to a convenient handle forms the gun. A slot at the front and several notches near the handle hold the rubber band ammunition under tension. The gun is operated by sliding the rubber bands out of the notches with the index finger. A little practice will soon teach the secret of rapid operation. Aluminum foil is wrapped around one end of the rubber bands to give the bands sufficient firing power.

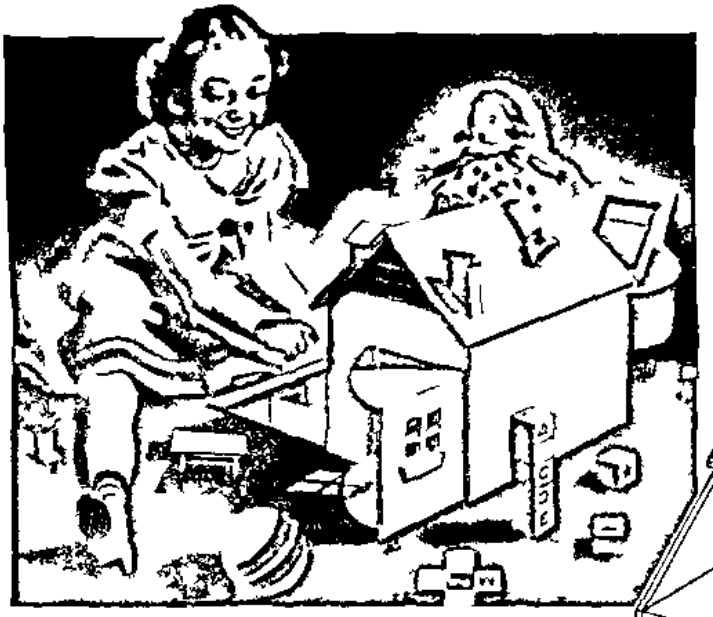
Any small simple glider may be used or one may be built of balsa wood as shown. The front end of the glider must be rounded so that it slides over the end of the catapult.



Six notches are cut in the dowel barrel for holding rubber bands

VEST-POCKET Doll House

By DICK HIXON



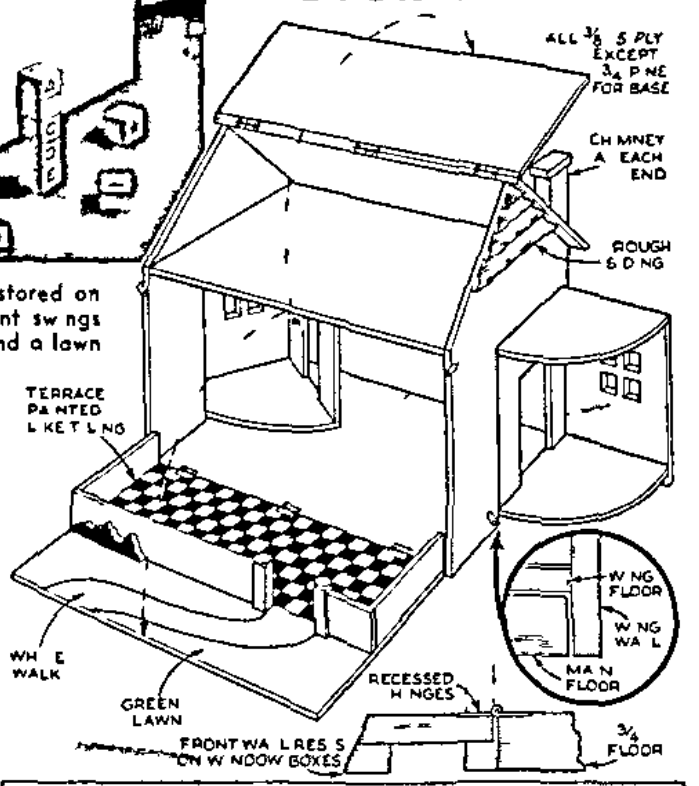
The doll house s small enough to be stored on a shelf or n a deep drawer The front sw ngs down to prov de an nclosed terrace and a lawn

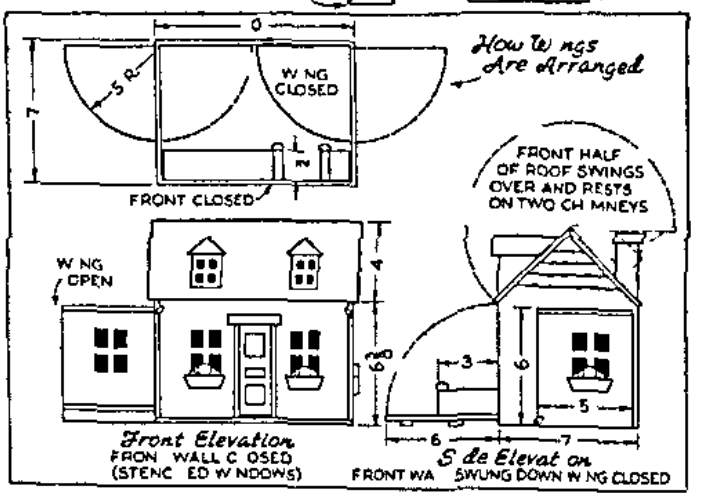
DESIGNED for apartments or homes where space is at a premium this tiny doll house can be stowed away under a bottom shelf or even in a deep drawer Nevertheless when the wings are opened out and the front dropped forward to form the terrace and lawn it accommodates a sizable doll family

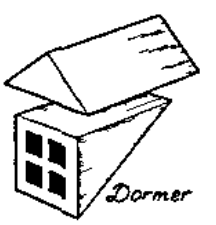
The baseboard is ¾" pine, and the house is constructed of ⅜" five ply plywood which is sufficiently thick to hold the screws of the small hinges for roof wings and front

Note that the front wall folds flush with the end walls and is held in the closed position by small catches which can be made of wood or metal When lowered the win dow boxes support it in the level position The windows may be stenciled on in blue instead of being sawed out Dormers are made up of two solid blocks each as il lustrated

Paint the outside walls cream the roof red and the window boxes green with colored flowers The main floor should be stained and varnished the terrace painted to resemble alternate gray and terra cotta tile and the lawn painted green The interior walls should be done in pale shades of your own selection or they can be covered with plain wall paper



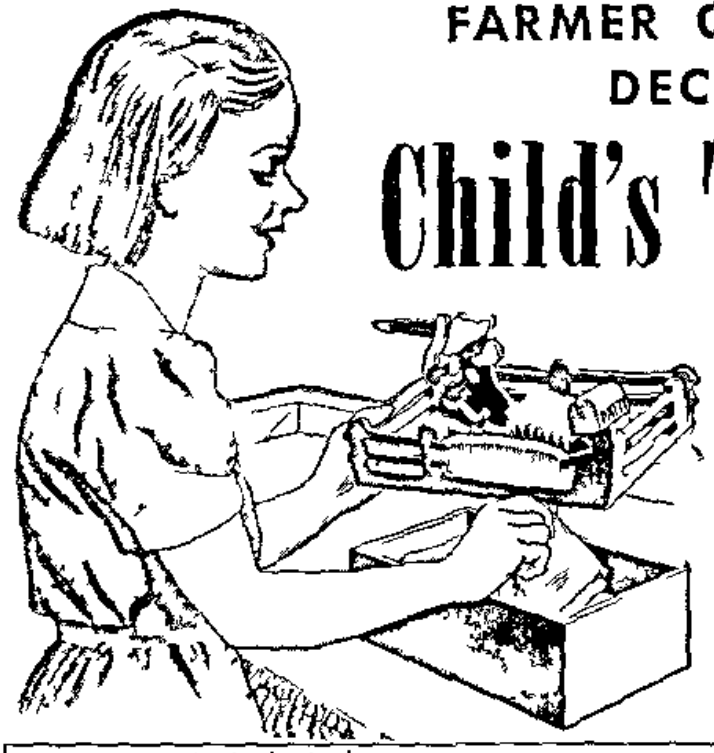


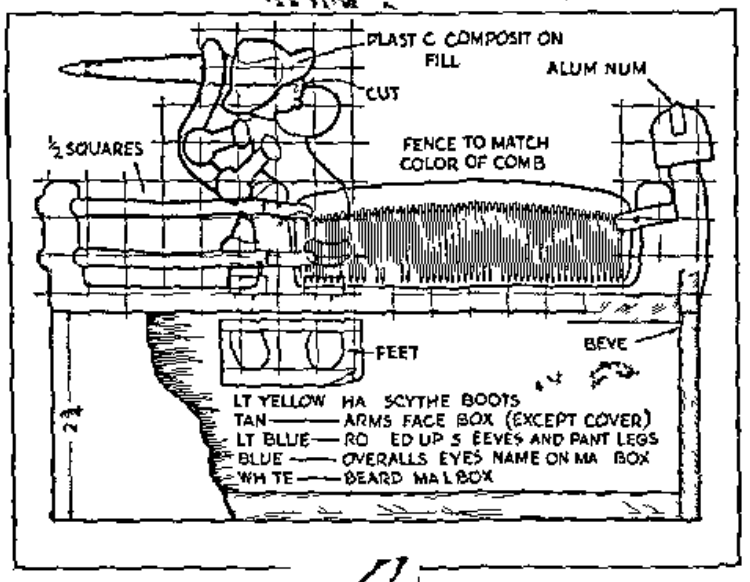


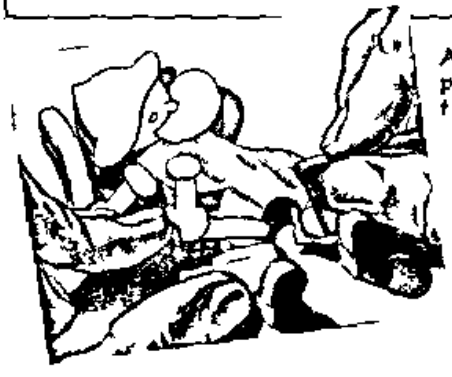
Shape the two dor me s and flower boxes from sol d wood The w ndows may be sten- c led n blue nstead of be ng sawed out

FARMER CUTTING HAY DECORATES

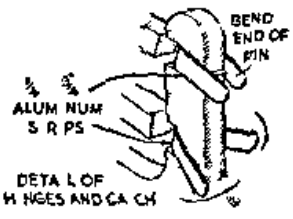
Child's Toilet Set







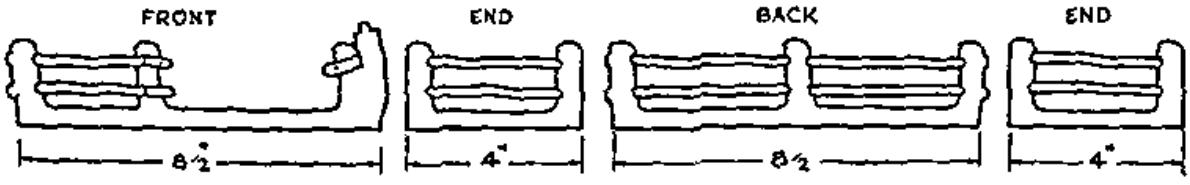
At left glue ove lays of pape on the fa mer then t m w th a razo blade

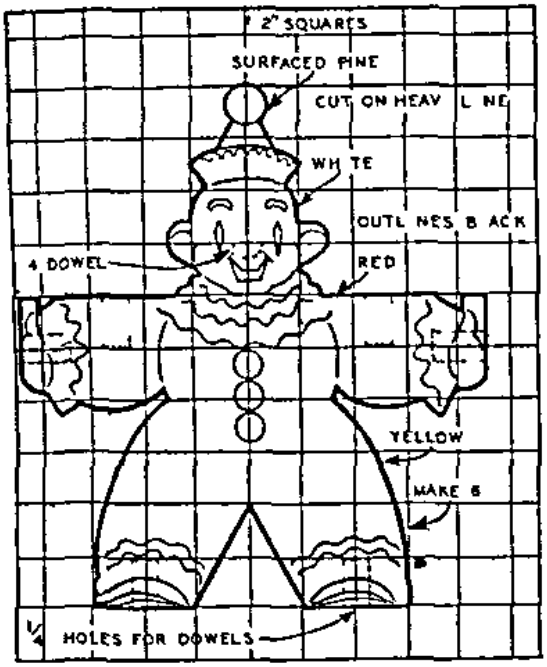


GOOD grooming is easy to sell to a small child with this comb brush and handkerchief box The hair brush (representing the hay) and an ivory colored comb should be on hand before start ing as their sizes may require the dimensions to be altered The fence is cut from ¼" ply wood Before gluing the fence rails attach the aluminum hinges The fence is nailed and glued to the ⅜ plywood box cover leaving ⅛" of the thick ness of the cover to fit inside of box Bevel the inside edges of the cover to insure an easy fit

The farmer is jig sawed from ¼ plywood Glue overlays of heavy drawing paper on the figure as shown in a small il lustration Trim them and make V cuts at the dividing lines when the glue has set to facili tate the painting Glue on the feet and make a mort se in the cover to receive them

Apply an undercoat to the box For a novel finish, mix artists o l color with a very small amount of varnish and apply with a coarse brush. Use uniform vertical strokes on the box and farmer and swirl strokes for cover fence and hairbrush handle Only white oil color is needed as any avail able enamel colors may be added to it for the tints Letter the child s name on the mail box Glue the farmer in place and apply felt on the bottom of the box.—THEODORE TORRISON







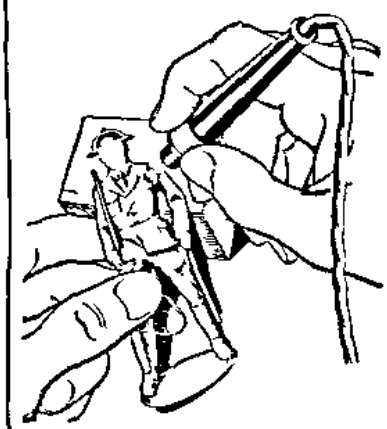
TOY WOODEN CLOWNS

CAN BE ARRANGED IN COUNTLESS WAYS

CHILDREN will be delighted with these colorful little clown acrobats because they can be put together so many ways

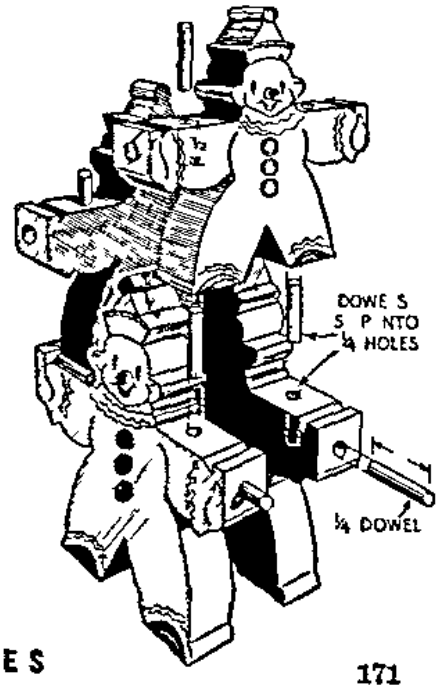
Draw the design full size on paper then trace six of the clowns on 1 surfaced pine stock, and cut them out with a jig saw Drill holes ¼" in diameter or slightly larger and 1" deep into the hands shoulders and feet of each clown as shown Next cut several 1" pieces of ¼" dowel These 1" lengths of dowel are the pins that hold the clowns together when they are built up one on the other and they must slip in and out of the holes easily Paint the figures for added appeal Face and hands can be white the suit yellow trimmings red buttons and shoes black —R. L. FAIRALL.

Delicate Soldering Jobs Done on Toys with an Ordinary Electric Pen

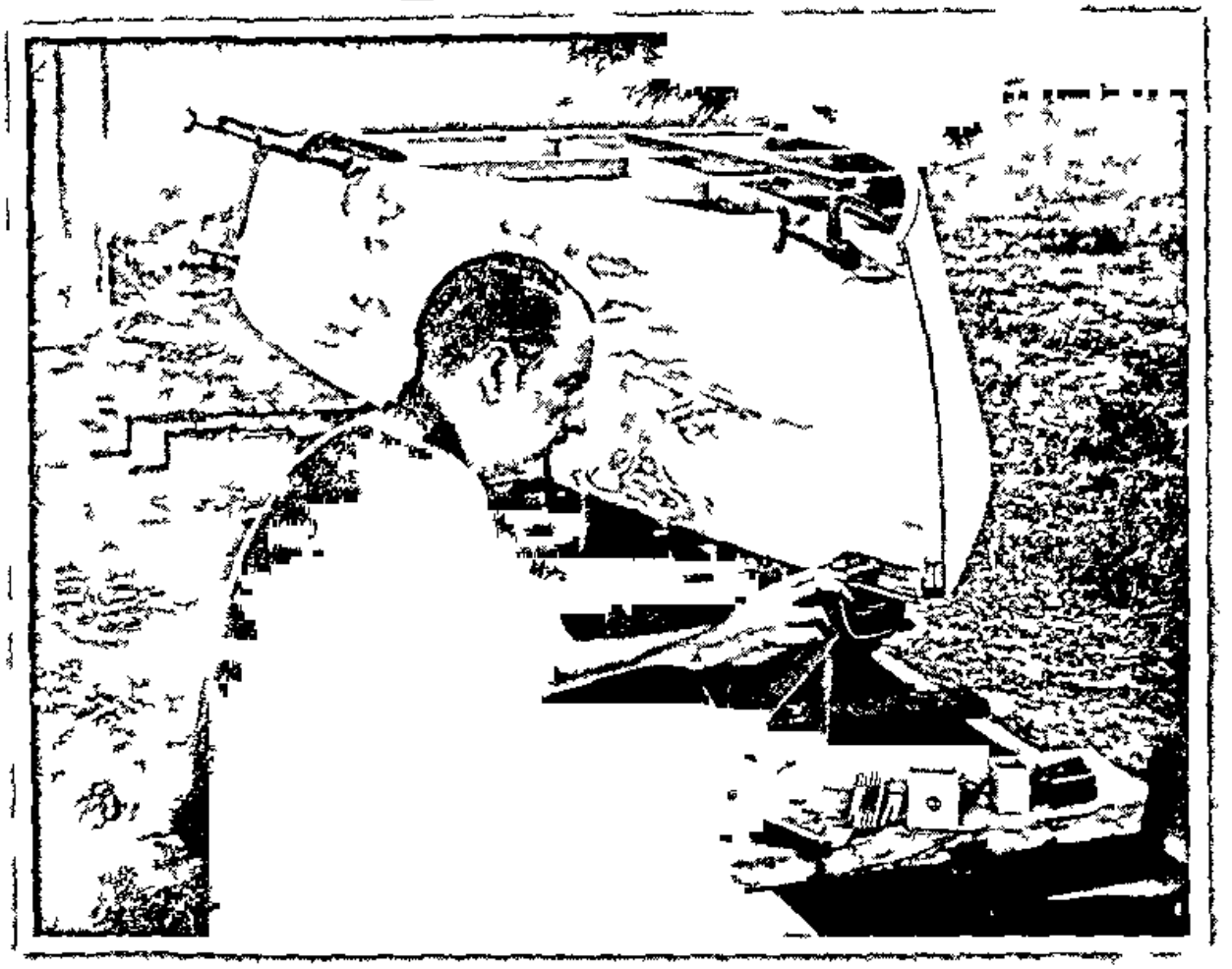


VERY small delicate soldering jobs are easier if an electric pen is used as a soldering iron

For example the pen may be employed for work such as soldering a broken arm on a toy solder where the heat from a large iron might melt the entire shoulder away and ruin the toy —R.B W



Waterproof Plywood



Re n bonded ma ne p ywood the g ea e t s ng e cont but on e e made to amateu boat bu d ng

THE pr nc pal advantages of the new waterproof marine plywood in boat construct on are the saving in labor that results from fewer seams and the add t onal strength obtained in proport on to weight It is well adapted for use as planking on many types of small l ght we ght boats and also for decking seats bulkheads floor boards and the like on all types of boats

Only res n bonded plywood made by the hot press process should be used Th s prod uct s sold under various trade names and comes n th cknesses of from ⅛ to 1 ₄ and in sizes up to 4 by 16 Even larger panels may be had on special order but the price per foot usually increases w th greater than ord nary lengths

If you are in any doubt as to the qual ty of the plywood to be used boil a sample of it in water for an hour or more This will separate the pl es of anything but resin bonded plywood Douglas fir is the wood most commonly used but the panels may also be obta ned in mahogany and various kinds of hardwood

To prevent the edges of the plywood from tear ng a very fine toothed saw should be used for cutt ng the panels and the edges should be fin shed w th a sharp plane set rather fine Exposed edges should be sanded off round for about the depth of one ply

Do not countersink for screw heads in fir plywood except near the edges Dr ve the screws t ght enough so that there is com pressed wood under the bevel of the screw head otherw se every screw hole will allow some moisture to enter the wood Dipp ng the screws in marine glue before they are inserted is also a good precaution

To prevent water logging and protect the indi idual plies from the stress resulting from the tendency to expand after absorp tion of water the edges of the plywood

for Boat Building

should all be sealed This can be done with resin primer (clear resin sealer) or with aluminum paint or marine glue

Bending of the plywood in one direction is easily done if the plywood is not too thick or the bend too great. If necessary it may be steamed or soaked in boiling water without risk of having the plies come apart Sharper bends may be made by making a saw cut through one ply on the concave side at right angles to the arc of the bend The saw cut should be filled with marine glue before the panel is fastened in position

It is only with great difficulty that plywood can be forced into any sort of double bend The amateur will find it quite difficult or impossible to make the bends necessary in a round bottom boat or in a V bottom boat where there is a pronounced concave flare or concave V in the fore sections For such purposes ordinary planking is much more suitable

Plywood is best adapted for planking only on comparatively short or lightweight boats as the panels are progressively more expensive per square foot in lengths over 8 For this reason it is often necessary or advisable in longer boats to use two or more panels to make the required length This of course increases the number of seams and the joints cannot be staggered as in the case of an ordinary planked boat No matter how carefully made these joints have a tendency to mar the appearance of the boat by interfering with the true curve of the sides and bottom

It is best and easiest to use a simple butt

By BRUCE and WILLARD CRANDALL



On small flat bottom boats the bottom as well as the sides can be in one piece Right how joints are made

joint backed by a butt block of the same material The planking should be screw-fastened to the butt piece along the edges close to the seam Also screw the butt piece along its edges to the planking The new resin glue (synthetic resin adhesive) should preferably be used at such a joint. Copper rivets should be substituted for the screws if the plywood is very thin or other glue than resin glue is used

If the splice comes at a point where there is a considerable curve in the side or bottom of the boat, it will be best to use a solid butt block $\frac{3}{4}$" thick or more in place of the plywood butt piece so that the butt block may be cut to conform to the shape of the boat at that point.

A long scarf joint may be used in place of the simple square butt joint, if desired so as to distribute the break in the planking over a greater length of the boat, but in many cases it may cause so much waste of material that it would cost no more to use a single panel for the entire length

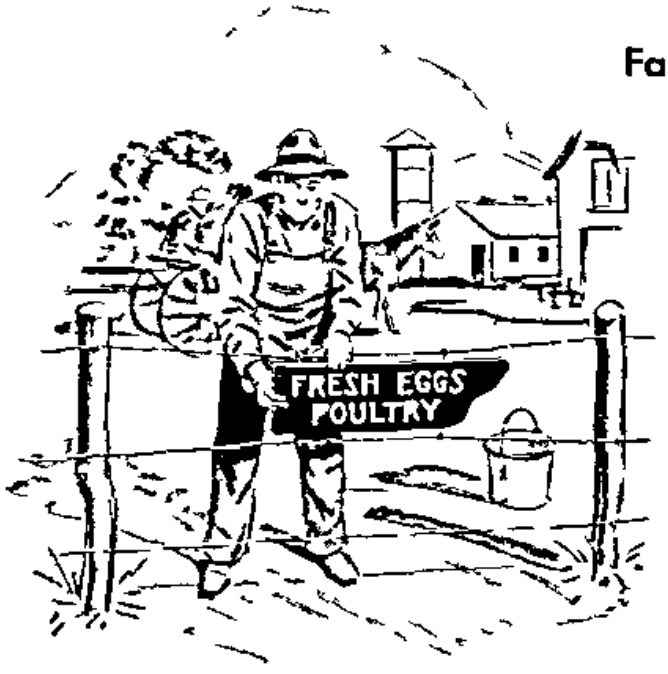
The grain in fir plywood has a considerable tendency to rise and the surface to check especially when exposed to sun and weather This may be minimized by the use of the resin primer as a priming coat for all exposed surfaces.

Especial care should be taken with plywood boats to prevent their rubbing continuously against any object, because plywood though very strong is thin and fir is a relatively soft wood. In case a hole is worn or punched in the boat, it is of course not possible simply to replace one plank as in other boats The entire side or bottom will have to be replaced or a patch made

To patch a hole the broken or worn part should be cut away and a similar piece fitted in its place backed by a butt piece and fastened with screws and resin glue by the method described previously for making a splice

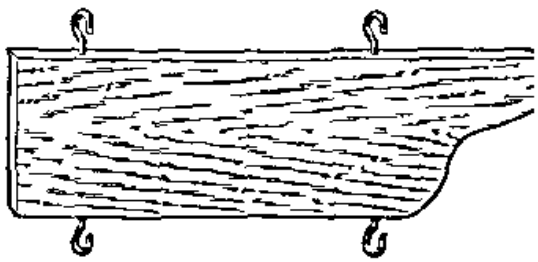
The following is a list of POPULAR SCIENCE MONTHLY boat plans published before resin-bonded plywood was on the market, which are nevertheless particularly well suited, for one reason or another, to the use of plywood planking The thickness of plywood given is in accordance with the type of framework described in the plans difficulty of the bends involved and the requirements of weight and strength Plywood may of course be used for many other parts than the planking in almost any boat.

Plan No	Boat	Plywood Planking Thickness
131 132 133 R	Combination boat	$\frac{1}{4}$" or $\frac{3}{8}$"
147 R	Motorboat rowboat	$\frac{1}{4}$" with all battens or $\frac{3}{8}$" with most battens left out
170 R	Folding duck boat	$\frac{1}{4}$"
204 R	Utility rowboat	$\frac{1}{4}$" or $\frac{3}{8}$"
257 R	High speed boat for small outboard motors	$\frac{1}{4}$"
261 262 R	Racing runabout	$\frac{1}{4}$" (About half the battens may be eliminated
281 R	Camper's utility boat	$\frac{3}{8}$" or $\frac{1}{4}$" (All battens as shown
309 310 R	Sport runabout	$\frac{1}{4}$" (All battens as shown)
314 R	Sai boat	$\frac{1}{4}$" or $\frac{3}{8}$"
321 322 323 R	Racing sai boat *Blackcat*	$\frac{3}{8}$" (Keelson or inside keel should be added)
331 R	All purpose boat	$\frac{3}{8}$"
339 R	Midget boat or pram	$\frac{1}{4}$" or $\frac{3}{8}$"
340 341 R	Sectional row boat	$\frac{3}{8}$" or $\frac{1}{4}$" (Battens can be eliminated)
344 345 R	Fisherman's outboard boat	$\frac{1}{2}$" (about half the battens may be eliminated)



Farm Roadside Sign Attached Between Fence Wires

FARMERS who wish occasionally to advertise produce for sale to passing motorists and tourists will find it convenient to use a signboard of the type illustrated It is cut from an 8" board and a pair of screw hooks are inserted in the edge at either side by which it may be quickly hooked on to two of the fence wires or taken off, as desired.—G E HENDRICKSON



for the Home Workshop

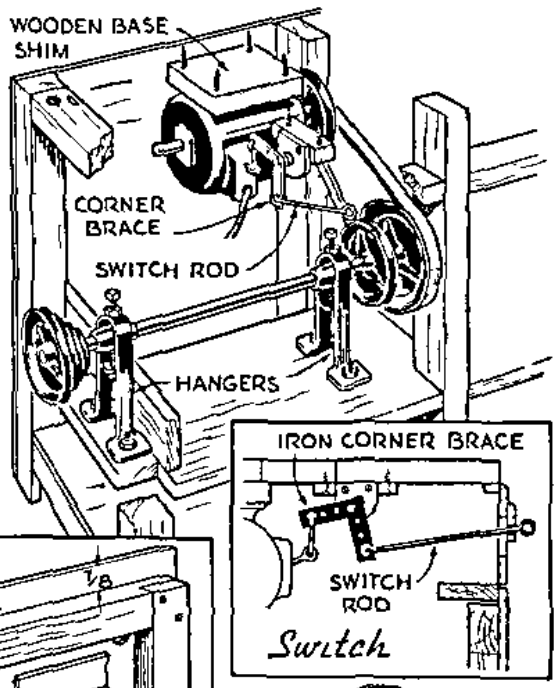
is provided to hold the lathe and this opens out to form an unobstructed table top 25" by 48" Such a table can be used in many ways in a shop where floor space is at a premium

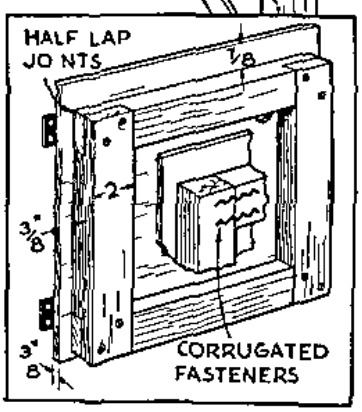
The turning chisels are kept in a rack that sheds off shavings For use it is lifted from the drawer and bolted on a pull out bar at the right end of the cabinet If the outboard turning of large parts has to be done the rack is fastened on a bar at the left end

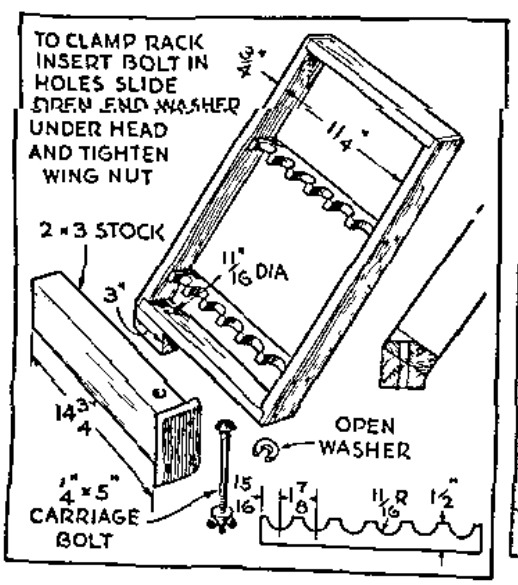
This cabinet can be fitted to almost any home workshop lathe a change in length being the only major alteration required The materials needed are listed on the next page

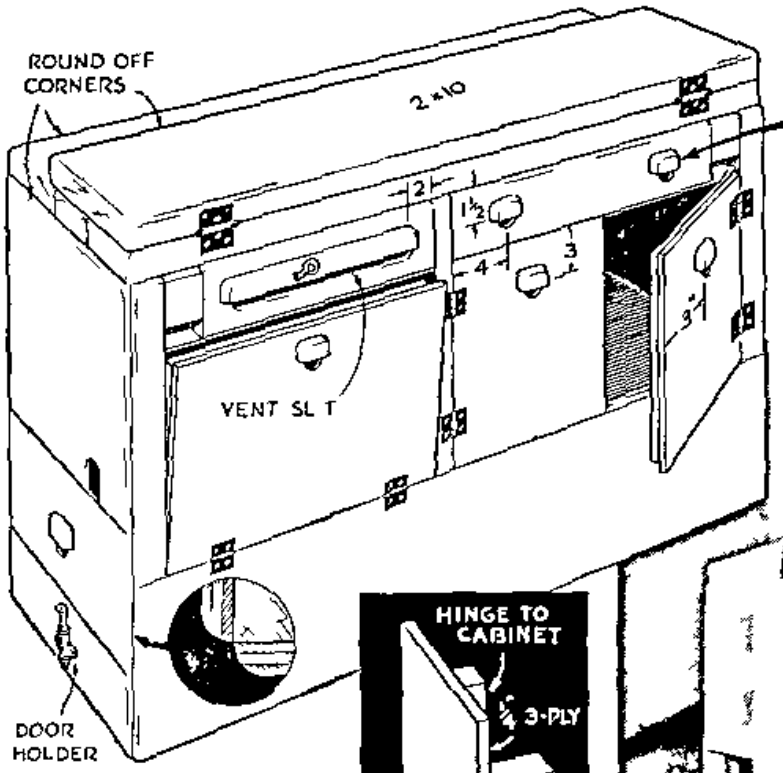
The top pieces may be butt glued with several corrugated fas teners driven into the underside However slip tongue joints are easily made with a dado head on the saw Make grooves ¼" by ½" in the edges cut a ⅞" plywood strip across the grain and glue it in the slots While the top dries cut the frame parts and bolt them together

Plane the undersides of the top at the ends to seat them on the rails and attach with lag screws having washers under the heads Draw up the center screws tightly but leave the outer ones slack

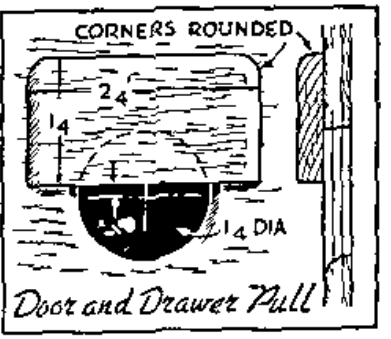




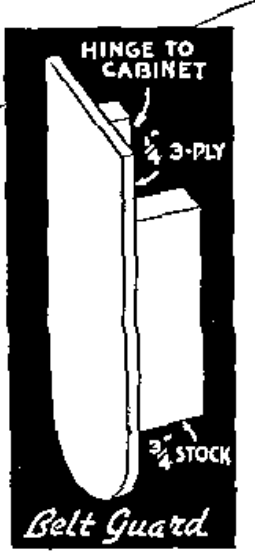




Sketch of completed cabinet At extreme right storing turning squares in the lower compartment







enough so that the top can slide when it shrinks and swells As less movement takes place at the middle the uprights at that point can be spiked through the top and lower rails Nail ¼" strips under the top at the edges and above the drawer sides and pull bars Toenail the drawer and vent rails and nail in runners and side guides for the pull bars

The floor boards are plywood supported by cleats in the center where the opening facilitates sweeping out and inserting a screw driver for attaching the motor shelf The height of the latter is determined by the belt.

Hinge the lathe plank to the top with the hinge joint sunk halfway so that the plank will lie flat Set the lathe on top and loop the belt over the pulley to locate the motor height Screw the shelf cleats to the uprights to suit or, if the shelf would be so high as to limit storage space unduly drop it and block up the motor

If a countershaft is used screw the shelf temporarily stand the countershaft as near the front as possible and locate the motor under the top according to its belt length If necessary, block it down A detail drawing shows a simple method of operating the

LIST OF MATERIALS

Part	No	Size	Length
Top	2	2"x6" S4S	48"*
	1	2"x4"	
	1	2 x10"	
Corner posts	4	2 x3"	27
Center	2		23"
Front and back rails	2		47"
End rails	4		12"
Drawer and vent rail	1	1 x3"	48"
Pull out bars	2	2"x3"	15
guides cleats	6	1 x4"	15"
Runners	3	1 x"	15"
Shelf	2	1 x6"	48"
	1	1 x4"	28"
Doors	6	1"x"	13"
	2	1 x2	40"
Drawer front	1	1 x3¾" net	24"
sides and back	1	1"x4"	54"
Sheathing †	2	¼"x48"	27"
	2	¼"x15"	27"
Bottom shelf and drawer bottom †	1	¼"x15"	74"

Hinges — 4 pr 1½"x1 ⅛" 1 pr 2 ⅛"x2½"
Four friction catches 1½" flathead screws 6—¼"x2¼" lag screws 8—¼ carriage bolts 3½" long 4—4½" long and 4—3 long 1—5" long 16 penny spikes ⅝" corrugated fasteners brads 4 penny finish nails

* Allow extra for length of toppieces
† Sheathing bottom shelf and drawer bottom are fir three ply wall board All other parts may be pine or fir

switch with a pull rod through the vent An iron corner brace pivoted on a wooden support serves as a bell crank

Carry the motor cord out behind the drawer rail and through a hole in the right end If it is too short for this method mount an outlet at the end for plugging in the cord Attach a heavy extension cord permanently to the outlet with a plug at the other end to connect to the circuit

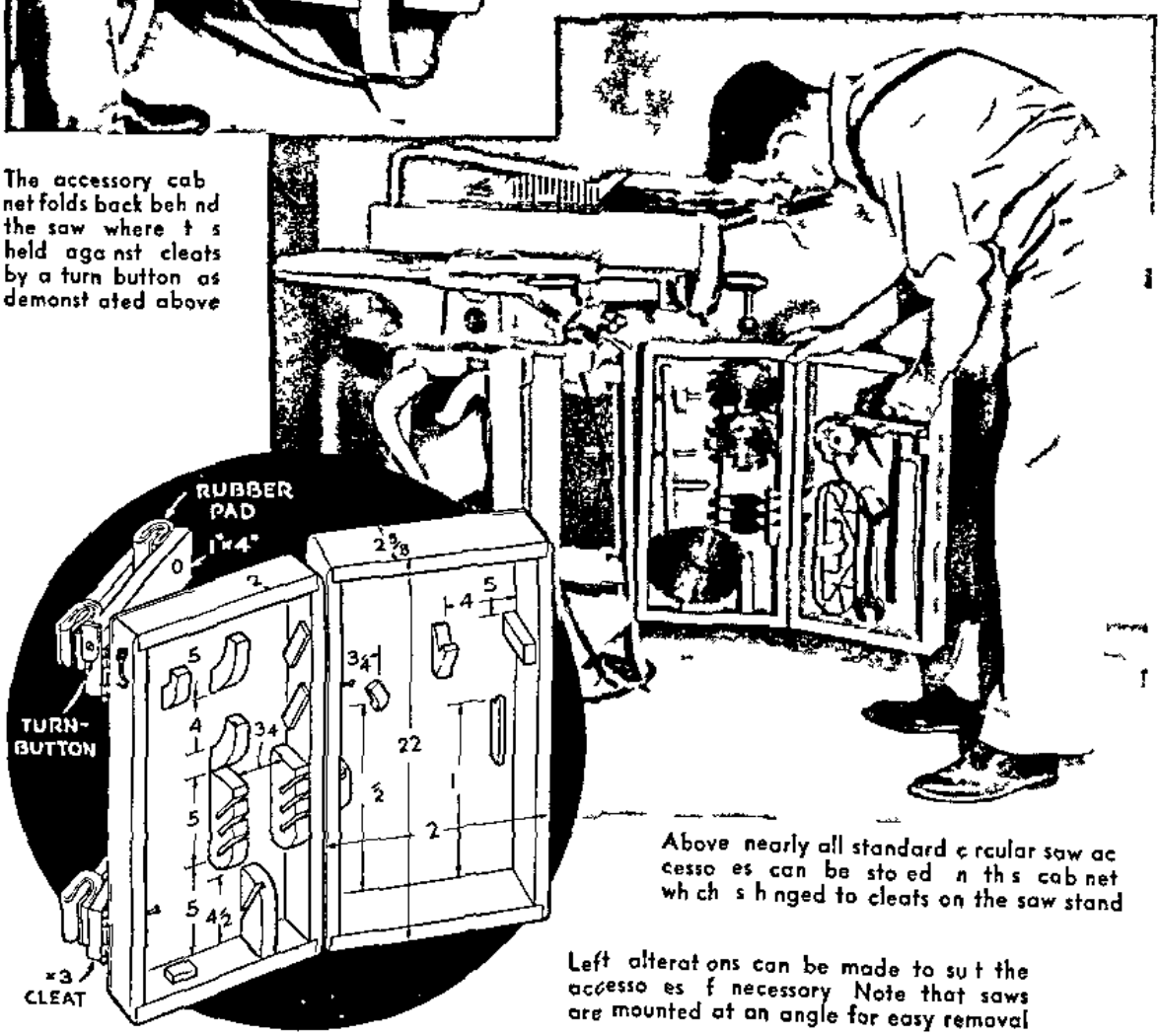
The plywood sheathing in front must be cut so there will be a ¼" projection of shelf edge and stiles (posts) for forming door stops Build the door frame about 3/16" smaller than the openings and glue and prad the plywood in place fitting it with 1/16 clearance all around The end door has two lugs glued to the back of the upper edge to catch behind the sheathing while the lower is held with a friction catch.

Make the ventilator and nail it in place Build the drawer with ¼" side and ⅛" vertical clearance Put it in place and scribe a pencil line on the bottom at each side of the runner to align ¼" guide strips Fit the ends of the front and round the top edge to conform to the sheathing

Fit the pull out bars rather snugly covering the front ends with plywood blocks which should be glued and nailed and fitted



The accessory cabinet folds back behind the saw where it is held against cleats by a turn button as demonstrated above



Above nearly all standard circular saw accessories can be stored in this cabinet which is hinged to cleats on the saw stand

Left alterations can be made to suit the accessories if necessary Note that saws are mounted at an angle for easy removal

to the openings like drawer fronts The open space beneath provides finger room

The drawing of the chisel rack is self-explanatory

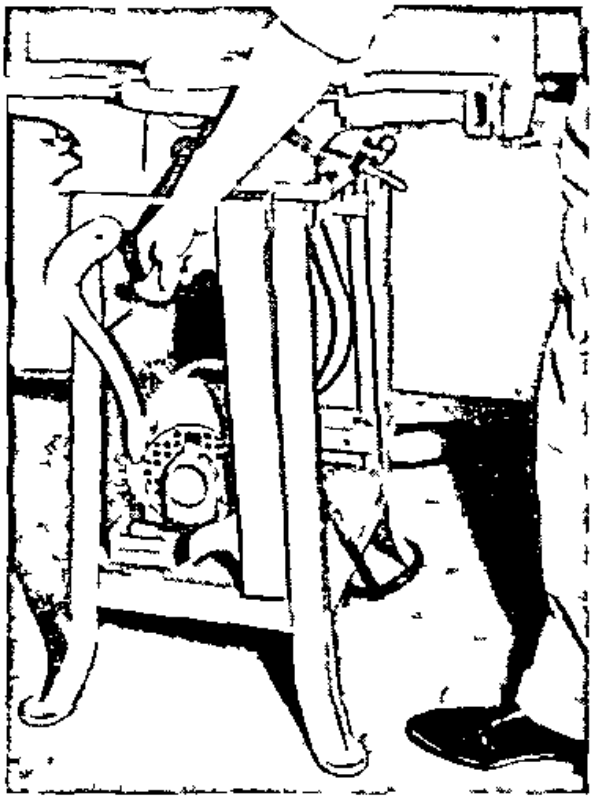
Roller skate wheels make cheap and durable casters They enable the cabinet to be jockeyed into place with little effort. A rubber tipped door holder screwed to each end and snapped against the floor will prevent creeping when the lathe is in use

To support the weight of the inverted lathe clamp a piece of 1" pipe in the tool holder Plug the lower end with wood and press on a crutch tip

A saw cabinet is also illustrated It folds back unobtrusively against the stand, but swings out instantly into the clear when open. The dimensions fit almost all standard saw accessories but alterations may be made to suit the builder The saws, being mounted at an angle are easy to remove The double cleats which are bolted to the saw stand (whether of the pressed steel or the cast variety) with rubber liners to prevent drumming provide hinge space A hook and eye lock the cabinet shut and a turn button on the end of the top cleat, above the hinge holds the cabinet back against the cleats when it is turned.

On steel stands, push sticks can be handily hung beside the jointer The jointer pusher or mitten has a hole in the front end and a sloping one in the side near the back end The first slips over a bolt end put in the shelf near the edge, the second catches a bolt passed through a hole drilled in the top flange and bent upward at 45 deg

The push stick for the saw hangs from another bolt through the rim of the top

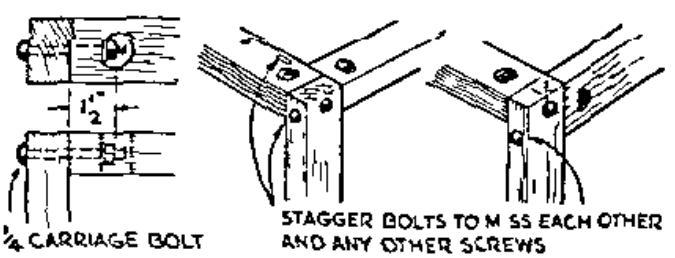


An upward and outward motion lifts the jointer push stick or mitten from the bolts on which it hangs

Robert Jaacks has begun the second year of his home workshop by arranging a down payment of $12 on a set of chisels and a wood turning lathe of 11" swing The monthly payments will be $6 out of his budget of $15 a month He also paid $4 down on a used 1/3 h p repulsion starting motor, to be paid for in three months

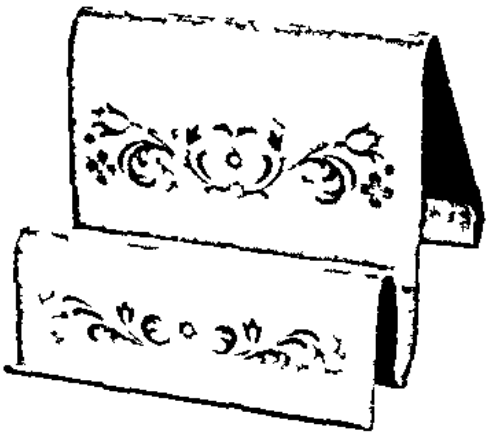
DRAW-BOLT JOINTS [WOODWORKING]

This joint is simple, quickly made, and capable of being tightened from time to time to take up slack due to shrinkage It is used mainly in 2" or thicker stock, for bench construction or other heavy framing 1 Square stock for the joint Gauge center line on width of rail and stile near joint end 2 Gauge center lines for thickness and width, on end of rail Gauge across stile center line from the end. 3 Bore 1" hole through rail thickness or nearly through, centered $1\frac{1}{2}$" from end Chisel out a flat seat for the washer 4 Bore $\frac{1}{4}$" bolt hole through stile, and from end of rail into large hole Bolt hole in stile may be counterbored to sink head flush (A dowel may be used each side of the bolt if desired to prevent any possible twisting of the joint.) 5 Put $\frac{1}{4}$" carriage bolt through stile and far enough into rail end to start nut on with washer underneath. Turn up nut until slack is taken up



POPULAR SCIENCE MONTHLY SHOP DATA FILE





Decalcomania designs are used for decorating the sheet cork facing The uncovered part of the sheet iron backing is painted with a bright enamel The rack is shown in use at the left

Decorated Cork Covers Face of Breakfast-Newspaper Holder

READING the morning newspaper while eating your breakfast becomes a greater pleasure when the paper is propped against this novel rack which was designed by a member of the Metropolitan Junior Achievement New York A strip of sheet iron 8 wide by 24 long is the supporting material On this a sheet of 1/16 sheet cork is glued. After the glue has dried the cork faced strip is bent as shown the highest peak being about 7" tall Paint the uncovered iron with bright enamel and apply decalcomania (transfer) designs to the cork

Wanted Three Hour Craftwork Projects

Have you built any original craftwork novelties that take only an evening to finish? If so send us brief well illustrated articles describing them Cash is paid upon acceptance for all available material

SOLUTIONS

[METAL ETCHING—1]

Etching solutions should always be mixed in glass containers Glass photographic trays are excellent for flat work Heavy square fish bowls are best for large work Earthenware is not satisfactory as the material unless very heavily glazed will absorb the solution

Nitric acid is used in etching most metals In many cases one part commercial nitric acid is added (CAUTION Do this very slowly and carefully) to one part of water Full strength acid may however be used with satisfactory results and much greater speed Where the process of etching is carried out with a slow etching solution it is well to stir occasionally or rock the tray from time to time to remove any bubbles and the scale that forms and interferes with even biting

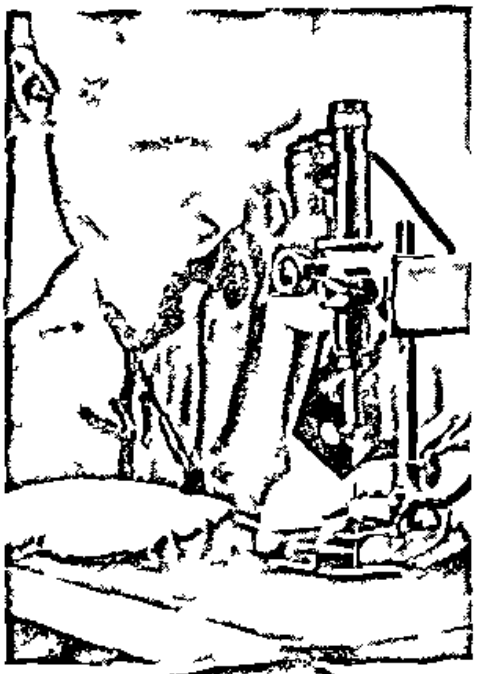
Store all etching solutions and clear acids in glass stoppered bottles To relieve burns received from acids apply sweet milk. Olive oil is next best If nothing else is available apply plenty of water

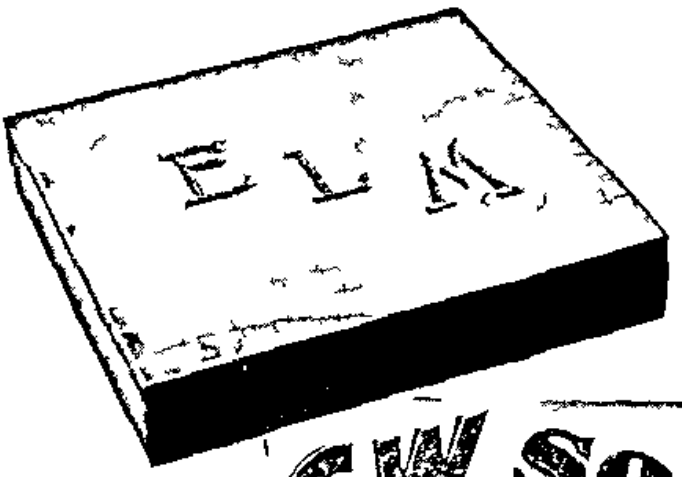
If in etching copper or brass it is desired to leave the undercuts dark to set off the work in a polished piece coat the etched parts with a solution of liver of sulphur (potassium sulphide) Wash this off before removing the asphaltum To make the solution dissolve a piece of liver of sulphur the size of a thimble in about a pint of water

POPULAR SCIENCE MONTHLY SHOP DATA FILE

Decorative Leather Initials

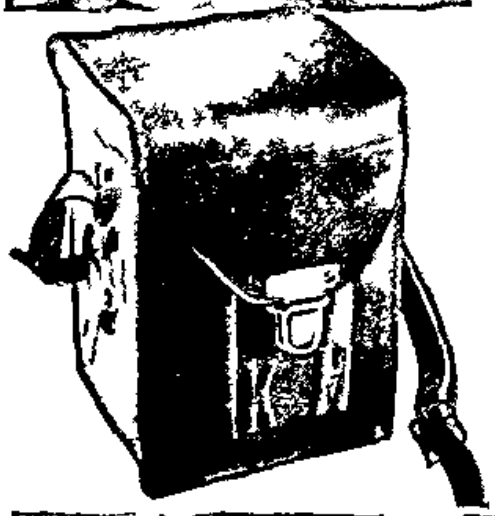
CUT OUT IN QUANTITIES ON A SCROLL SAW

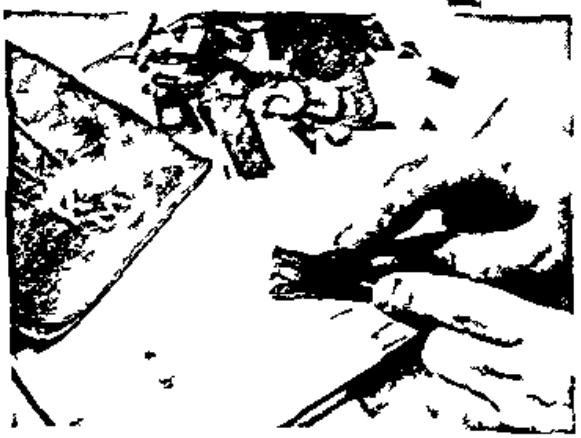




A large number of initials may be cut at one time on the scroll saw as shown at the left. Use a very fine saw blade







Large initials may be hand tooled to match any leather article to which they are to be applied

WHETHER or not you have ever attempted leather craftwork you will find the making of leather initials and monograms is a practical hobby. Under favorable circumstances it might also be developed into a profitable one.

Identifying initials are desirable on so many different articles in addition to those made of leather that the list is endless. Thin metal initials however bend out of shape readily or become dented; those of thin plastic break easily and transfer initials wear off all too quickly. Leather initials do not have any of these objections and you can apply them either plain or hand tooled to any type of surface with cellulose household cement.

Scraps and small pieces left over from leather work projects are entirely suitable. While the cutting may be done by hand the secret of rapid production is to use a scroll saw. Cut the pieces into uniform squares using a print trimmer if one is available. Stack the squares into blocks up to 1 inch thick fastening them together with rubber cement. To the top cement a tracing of the initials or monograms. Suitable letters can often be clipped from magazines and newspapers and these may be cemented to the blocks without taking the trouble to make a tracing.

If a power scroll saw is used the blade should be a very fine one. The writer uses thin narrow blades intended for cutting

jig saw puzzles When the cutting has been done separate the individual initials and rub off the rubber cement from both sides.

For most purposes the initials are used plain but they can be dampened and hand tooled with border lines or embossed designs if it is desired to match the leather article to which they are to be attached. Special leather modeling tools are not required because a nail set punch or awl can be ground or rubbed on an oilstone to a smooth blunt point that will give the kind of line required

Aside from tooling the initials they can be given a number of attractive finishes by other means. A bronze appearance is obtained by painting the leather with a solution of one part methyl violet in eight parts of water the measurement being made by weight. To give the effect of white veining rub in a little paste white lead—that is white lead ground in oil—and then remove the excess and allow it to dry

For a patent leather finish mix 1 oz of asphalt varnish with 5 oz raw linseed oil and add 2 oz of copal varnish Up to 5 oz. of turpentine may be mixed in to thin the material to a flowing consistency

With or without a special finish the initials are attractive on hand bags gloves cameras and camera cases luggage and many other articles —KENNETH MURRAY

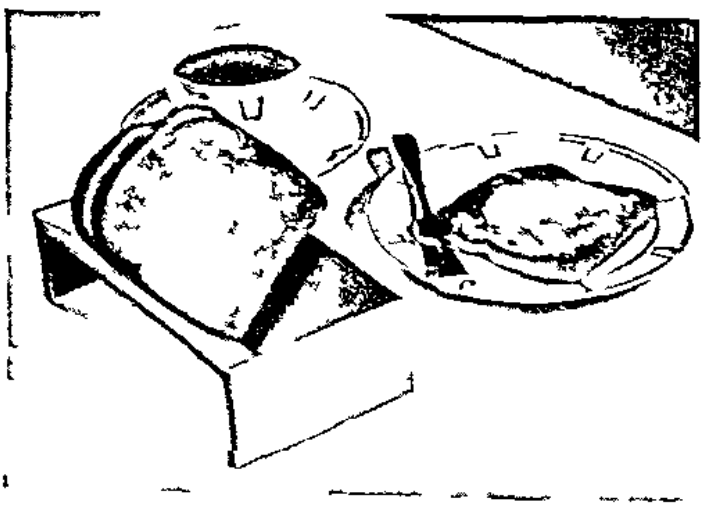
Toast and Bread Tray of Brilliant Plastics

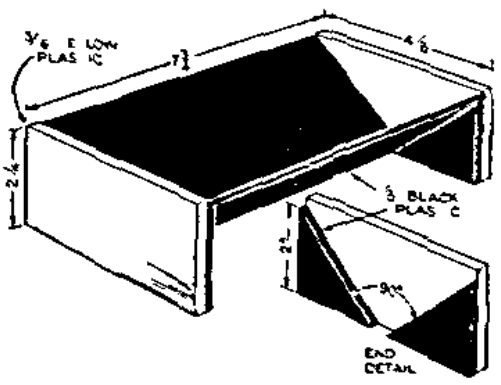
SPARKLING color contrasts and ease of working make modern plastic materials extremely desirable for home workshop use as in the case of this small toast and bread tray It is built up of 1/8 black and 3/16 yellow plastic

The sides are 3 by 7 3/8 Carefully miter the long lower edge of each by planing the material against mitered guide blocks The planed edges are roughened with coarse sandpaper and joined in a clamping jig with the special transparent cement sold for fastening the plastic material The ends of the tray are made of three pieces each—one yellow end rectangle to which is cemented two black 45-deg triangles. All excess cement must be scraped lightly from the joints before it has set.

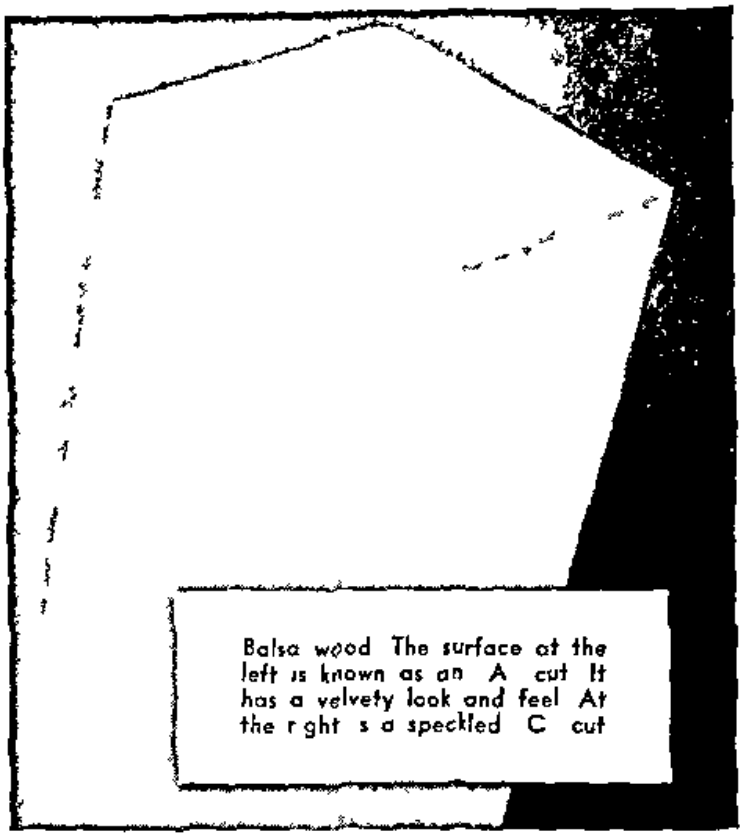
The completed tray may be buffed with an unsewed wheel and some plastic buffing compound or a highly satisfactory sheen will result merely from rubbing the material with very fine steel wool.—TOM E. MOORE.

CLOCKED PROJECT — Average Time 4 hours









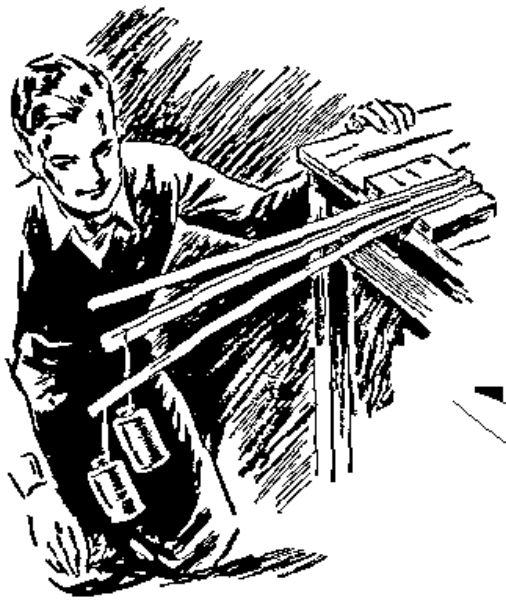
Balsa wood The surface at the left is known as an A cut It has a velvety look and feel At the r ght s a speckled C cut

What Model Makers Should Know About BALSA WOOD

By FRANK ZAIC

IN ECUADOR there are trees that mushroom up to heights of from forty to sixty feet in a comparatively short time It is not unusual for them to attain diameters of from 12" to 18" within five years If you were to follow one of these trees through the many processes that lie between the living tree and usable wood you would eventually find it on the workbench of a model airplane builder This in a nutshell is the life story of the world s lightest wood balsa

The weight of balsa has been standardized at 8 lb per cubic foot, but it varies in practice from 4 to as high as 20 lb The rate of growth and the resulting weight depend on the local conditions The growth is greatest in open spaces near water and where the





Above method of test ng balsa wood and basswood Both woods have approx mately the same we ght but the basswood bends tw ce as much At r ght all balsa model us ng C cut for all parts except the prop

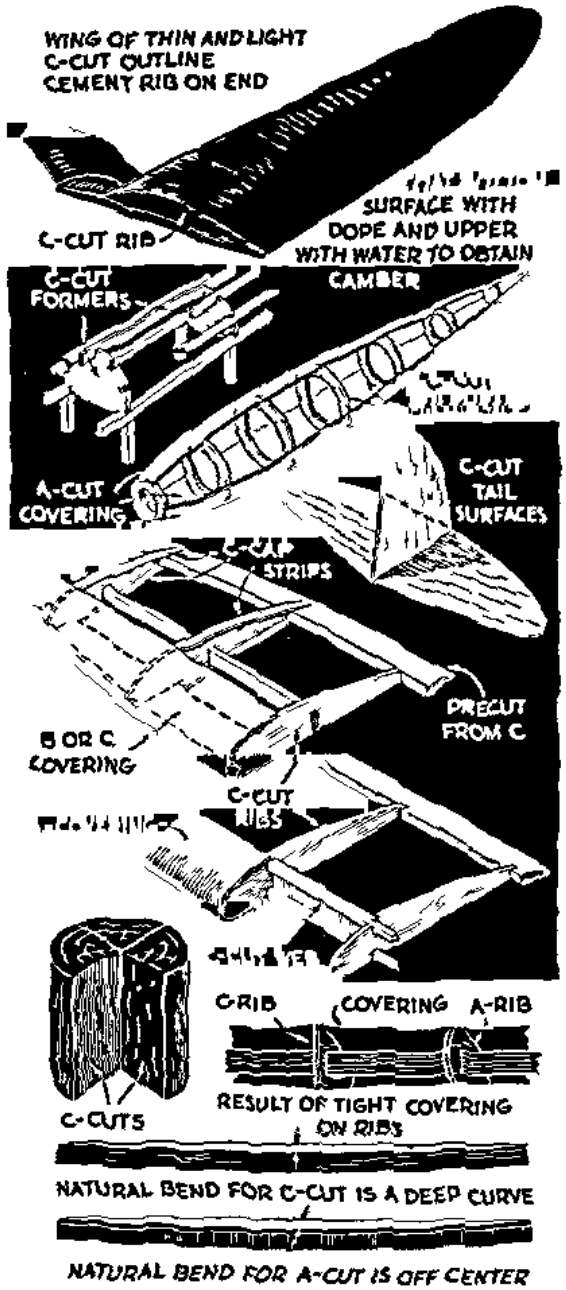
soil is moist. The lightness and softness of balsa is due to its large, thin-walled cells It is easily compressed with a finger nail, and nails or screws cannot obtain a secure hold. It takes glues or cements exceptionally well because its large, open cells allow the adhesives to flow into them and thus insure good anchorage

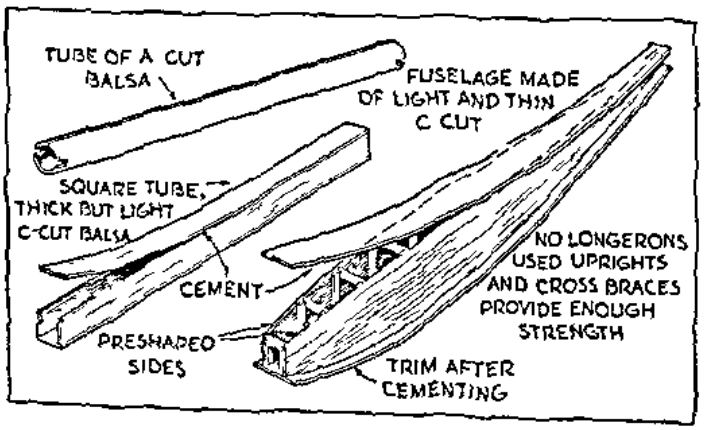
Although balsa is used for many commercial purposes, such as floats and insulation boards the bulk of the output is employed for model airplanes It is estimated that American boys use about 3,500 000 board feet of balsa every year (A board foot is 1" by 12" by 12")

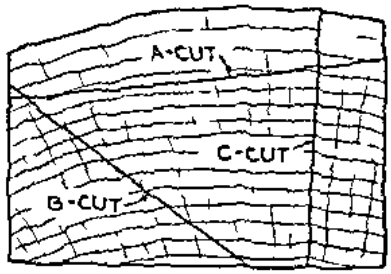
The advantage of balsa over hardwood for model airplanes lies in the ease with which it can be shaped with a sharp knife or a razor and also the fact that it can be used in comparatively large sizes It is well known that deep spars produce rigid construction For example a 1' by 2" spar when equally loaded while it is laid flat and on edge, will bend twice as much in the flat position Also, if the size is increased to 1" by 4" and a similar load placed on its edge, it will bend only one quarter as much as the 1" by 2 did while also on edge

Since balsa is so much lighter than hardwood we can use large spars to produce rigid construction with lightness—a most desirable condition for model planes, which have to maintain their aerodynamical settings for flying and stability

You can easily test the comparative bending qualities of balsa and hardwood Cut a $\frac{1}{4}$" by $\frac{1}{2}$" by 12' strip from 8-lb balsa, and a $\frac{1}{8}$" by $\frac{1}{4}$' by 12" strip from basswood Both pieces will weigh approximately the same since basswood weighs about 30 lb per cubic foot. Cement the ends of a board and suspend equal weights from the free ends You will find the basswood bends about twice as much as balsa, just because it has less cross sectional area for similar weight. It is of course, understood that both strips would very likely break at similar maximum loads, since the strength







Above how the three cuts are obtained from a balsa log At top and at left methods of using balsa in model airplane construction

of a material is more or less determined by its specific gravity Balsa can be used highly loaded without having it bend excessively or we can say that balsa is much more brittle than ordinary hardwood

The natural grain characteristics of balsa are similar to those of hardwood Balsa sheets cut along the three lines shown in the drawing of a portion of a log have the same characteristics as those cut from hard wood A sheet cut along the line marked A has a velvety look and feel It will be *found to bend very easily into tubular form* A piece cut like B has tiny speckles and feels stiffer when an attempt is made to bend it into tubes C has large speckles and a glazed surface and it is especially brittle against tubular bending These special characteristics can be used advantageously for model work

The so called C cut is perfect for compression members such as ribs and bulkheads also for all balsa models It can be loaded three times as much as an A cut of similar size before it will bend or buckle But when it does buckle it will do so without a warning and will snap cleanly into two C ribs will keep shape under covering pressure that would normally double up the A type

Bulkheads can be made from single C sheets instead of double ply Use the C cut whenever possible to obtain maximum strength with minimum of weight The C cut will bend to some degree the exact radius depending on its weight and thickness Light thin and moist C sheets can be made into tubes but only after you have had some experience One of the main rules is to keep the wood under constant tension as you roll it around the bending rod.

The A cut is a natural bender and can be bent considerably without moistening When moist it will bend into surprisingly small diameters Use it for tubes and for covering sharp curves

B cuts have the in between characteristics of A and C *They should be used* when bending requirements exceed the C specifications but are not so severe as those which only A can handle

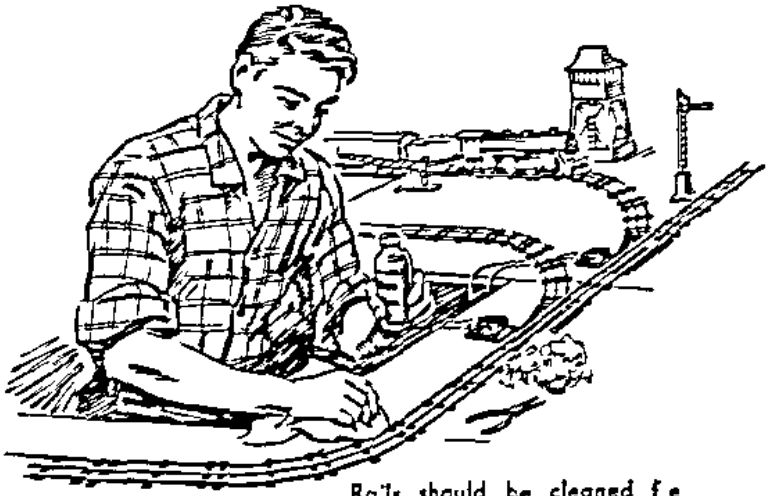
So far we have covered the grain uses pertaining to sheet stock Although C cut is best for deep spars because it will resist twisting forces it was found that such spars will have a natural tendency to curve so that it is difficult to make surfaces flat Since it is more important to have a perfect aerodynamical line up than a slightly stronger construction we have to be satisfied with spars cut from A stock The natural bend on A spars is in a direction easily counteracted during construction. Use C stock by all means when the outline such as trailing edge is of curved variety and cut from sheet Just consider in each case which you would rather have —a good anti twisting but possibly bent spar or the straight A type

(TO BE CONCLUDED)





Above an example of multiple stringer construction Note the smooth lines of the plane At the left the Good brothers with their balsa model controlled by radio which has been a consistent winner at model airplane meets during the past three years



Rails should be cleaned frequently by wiping them with a rag moistened with carbon tetrachloride or similar cleaner

Track Maintenance

ON YOUR MODEL RAILWAY

By

C. ELMER BLACK

KEEPING track in good condition is every bit as important on a tin plate model railway layout as on a real system Eventually neglect results in short circuits and in the general slowing down of the trains and unsatisfactory operation of the system.

Before assembling a layout, pinch the openings in the rails in which the pins of adjoining sections fit. Use a pair of long nose pliers placed between the opening and the bottom of the rail as illustrated. In addition, rub down the tops of the rails and pins with a very fine grade of steel wool. Make sure the track connectors hold the sections tightly together

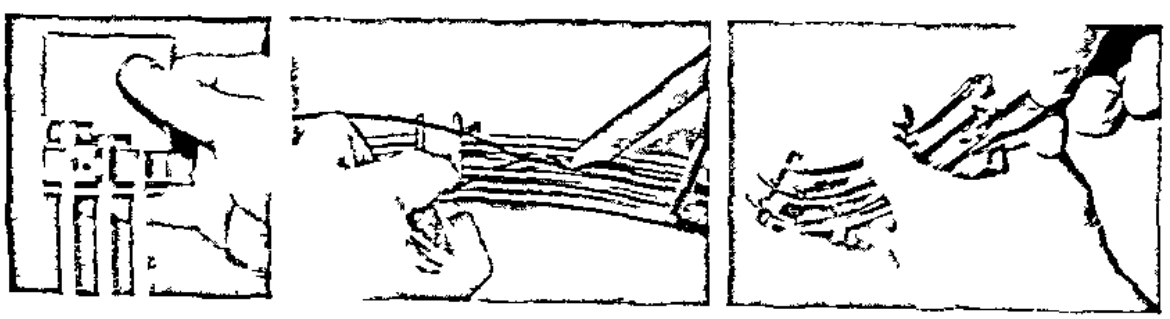
Check the insulation of the middle rails by connecting two wires to a dry cell, or to the transformer Hold one end on the outside rail and touch the other to the middle rail. If a spark results replace the insulation material under this rail at the three points where the rail is clipped to the ties

The most efficient way to introduce current into the system is to solder wires to the underside of the rails This prevents loss of voltage due to poor connections and on any but the smallest layout this should be done about every five sections Use red-covered insulated wires on the middle rails and black-covered insulated wires on the outside rails The colors make identification easy

On curves place short lengths of match sticks under the outer edges of the ties to give sufficient elevation to allow the train speed to be increased without the danger of derailments

For an extremely smooth riding surface the ends of the rails may be staggered so the wheels do not bump over the joints in the track at one time This takes time but is worth the trouble Do not disturb the middle rails which are insulated but loosen the clips holding the outside rails to the ties and slide one rail forward and the other back $\frac{1}{4}$" either way from the end of the middle rail. Then retighten the clips At points where switches or crossings join, saw off the ends of the track sections square as it is not practicable to alter the switches or crossings

After the system is in operation clean the rails frequently with a rag moistened with carbon tetrachloride or other safe cleaning fluid.



Using a gauge with $\frac{1}{4}$" steps to stagger the rails so the wheels do not bump over all the joints at once Center soldering feed wires to the underside of the rails Above pinching openings in the rails This creates tighter joints when pins of adjoining sections are pushed into place

FIVE STUNTS WITH



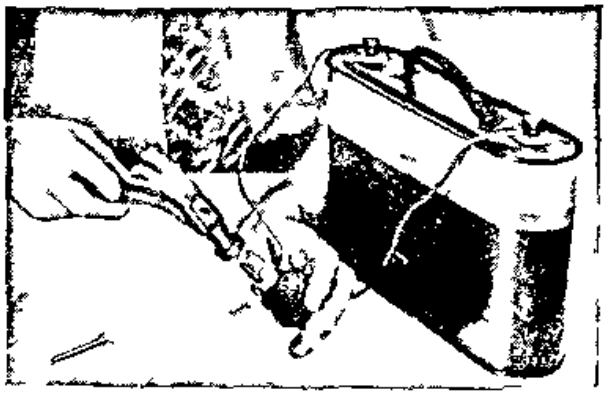
Simple Meter Is Made of Coil and Compass

WIND a dozen turns of insulated wire around a cardboard ring insert a small compass and you have a handy meter for volts or amperes A pencil sharpened at both ends and inserted in series with the circuit as shown at bottom of opposite page will form a resistance of graphite to raise the voltage range To increase the range for amperes instead a parallel connection or shunt by passes the meter At left it is demonstrating the surprising fact that the size of a wet or dry cell has nothing to do with its voltage as shown by the compass needle's deflection However big cells give higher amperage and last longer

Tiny Homemade Cell Shows How Electric Motors Work

MAKE a loop of copper wire about two inches in diameter Pass the ends through a large flat cork and solder them to small squares of zinc and copper respectively When this tiny electric cell is floated in a tumblerful of dilute sulphuric acid current flows through the loop and sets up a weak magnetic field Bring an electromagnet near and the coil will align itself and slip over it Reverse the battery connections of the electromagnet and the loop backs off turns around to present its opposite face and slips on again Electric motors apply the same principle





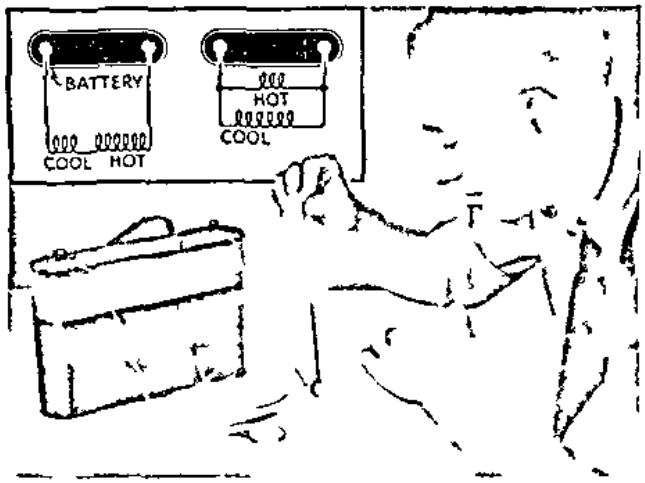
It's Easy To Magnetize Small Pieces of Steel

SCREW DRIVERS scissors and compass needles are easy to magnetize permanently Wrap fifty turns of bell wire around a cardboard tube of about half inch diameter Connect this improvised solenoid or coreless magnet to several dry cells To magnetize an object simply insert it in the tube for a few seconds while the current is on meanwhile tapping it with a hammer This helps the molecules of steel to disentangle themselves and line up in one direction giving the object its magnetism Soft iron cannot be used for permanent magnets

ELECTRIC CURRENTS

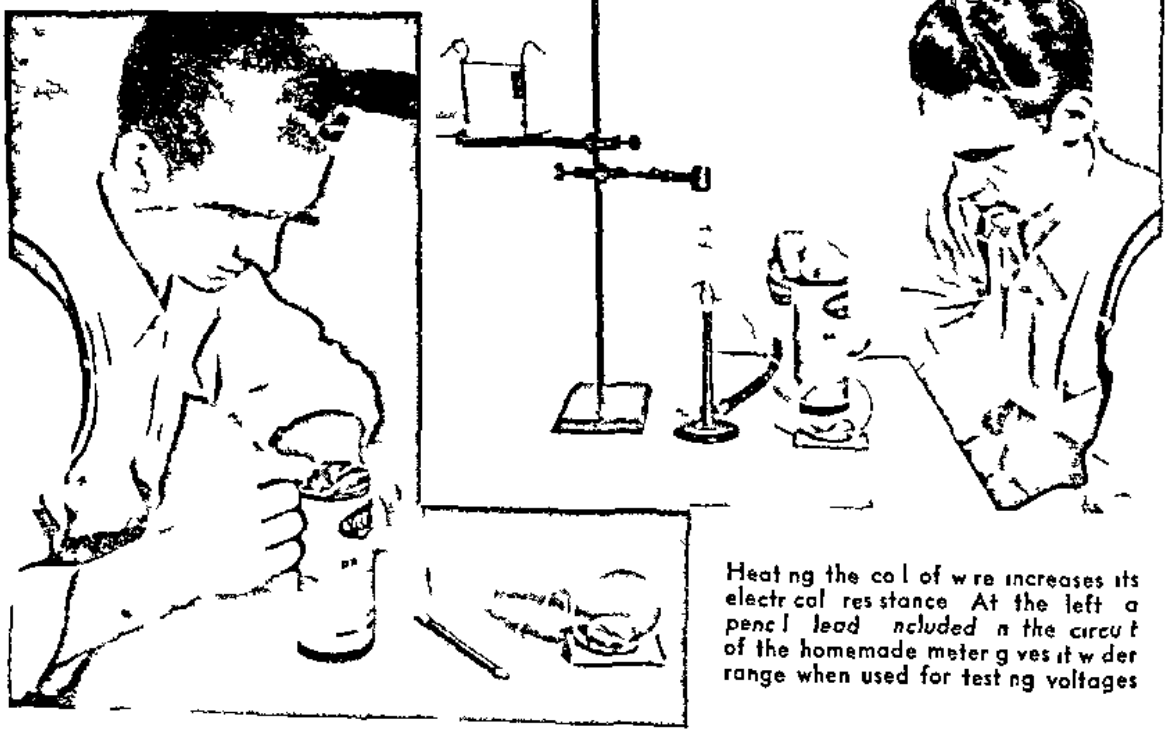
Changing Circuit Gives Different Heat Effect

TO SEVERAL dry cells connect in series two coils of fine insulated wire one of fifty turns and the other of 100 turns Place a chemical type thermometer within each coil and read its temperature after current has been flowing exactly one minute The 100 turn coil becomes the hotter Re arrange the coils in parallel repeat the tests and you will find that with this circuit the 100 turn coil is the cooler one



How Temperature Affects Resistance of a Conductor

CONNECT your homemade electric meter in series with a small coil of bare wire and a dry cell Heat the bare wire coil and the current will decrease as shown by the lessening deflection of the compass needle The resistance of the wire has been increased by heating so that less current is allowed through Now substitute a beaker of cold salt water for the coil and connect the wires to metal plates dipping in the liquid In this case heating the salt water will indicate a greater flow of current on your meter owing to lessened resistance of the conducting solution This illustrates a general rule of electricity—that heating a solid conductor usually increases its resistance while heating a liquid conductor or electrolyte usually diminishes its resistance No pencil resistance is needed as this is an amperage test

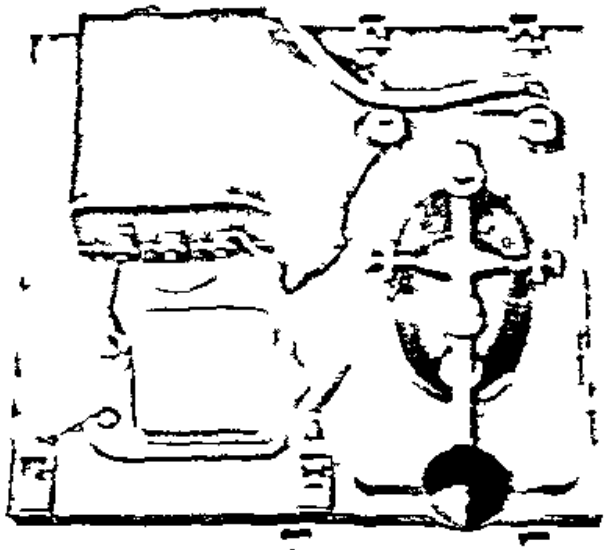


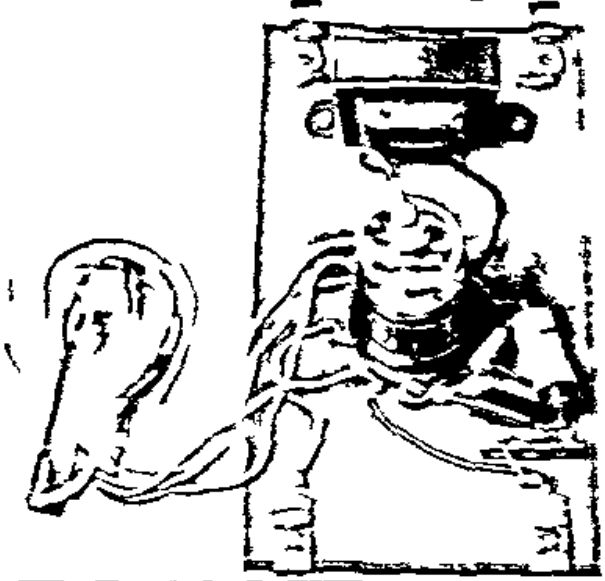
Heating the coil of wire increases its electrical resistance At the left a pencil lead included in the circuit of the homemade meter gives it wider range when used for testing voltages

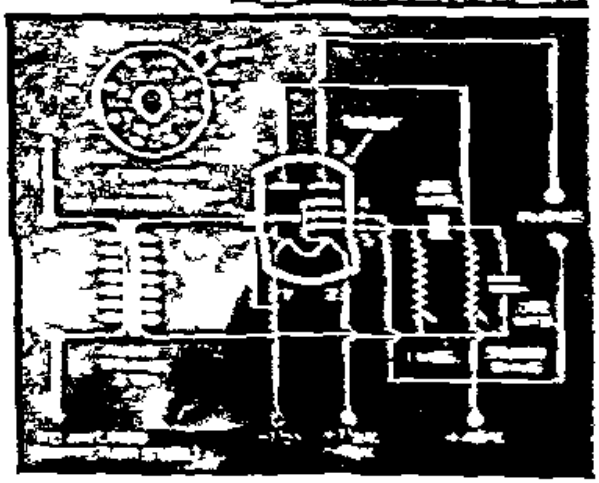
HOMEMADE

"Audio" Telegraph

NEEDS NO WIRES

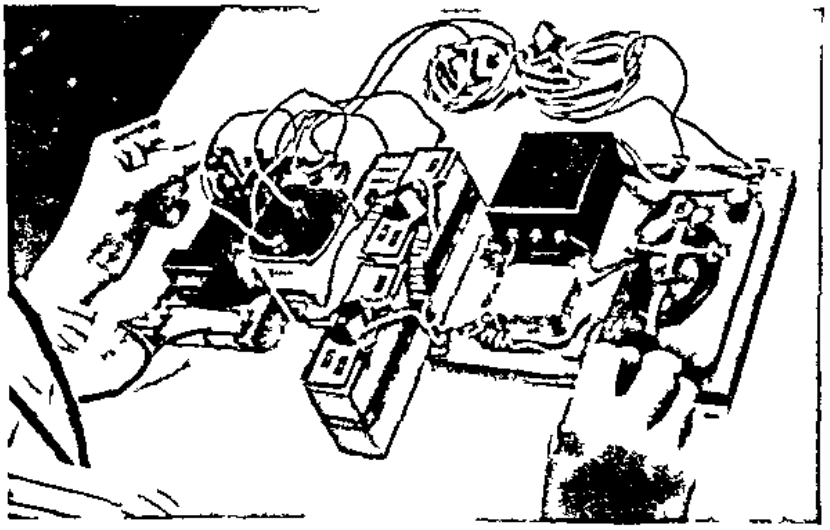




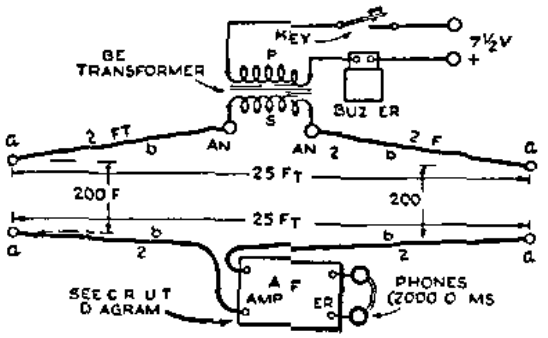


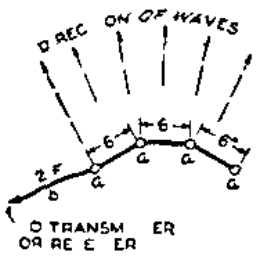


I mounted the parts on a 7" by 8 baseboard It can of course be placed in a cabinet or it and the receiver can be housed together in a compact portable carrying case When buying the bell trans former which is the only crit cal part in the transm tter circuit make sure that it pro s des a 110 volt pri mary and a 12 volt sec ondary In the actual hook up the windings are used n reverse—the 12 volt winding serving as the primary and the 110 volt wind ing as the secondary *Connections to the cop* per antenna rods and to the 7½ volt battery can be made through Fahnestock clips screwed to the base board (See next page)



Follow th s a rangement n mount ng the parts of the two un ts on the r baseboa ds Below how transm tte rece ver and ground rods a e set up

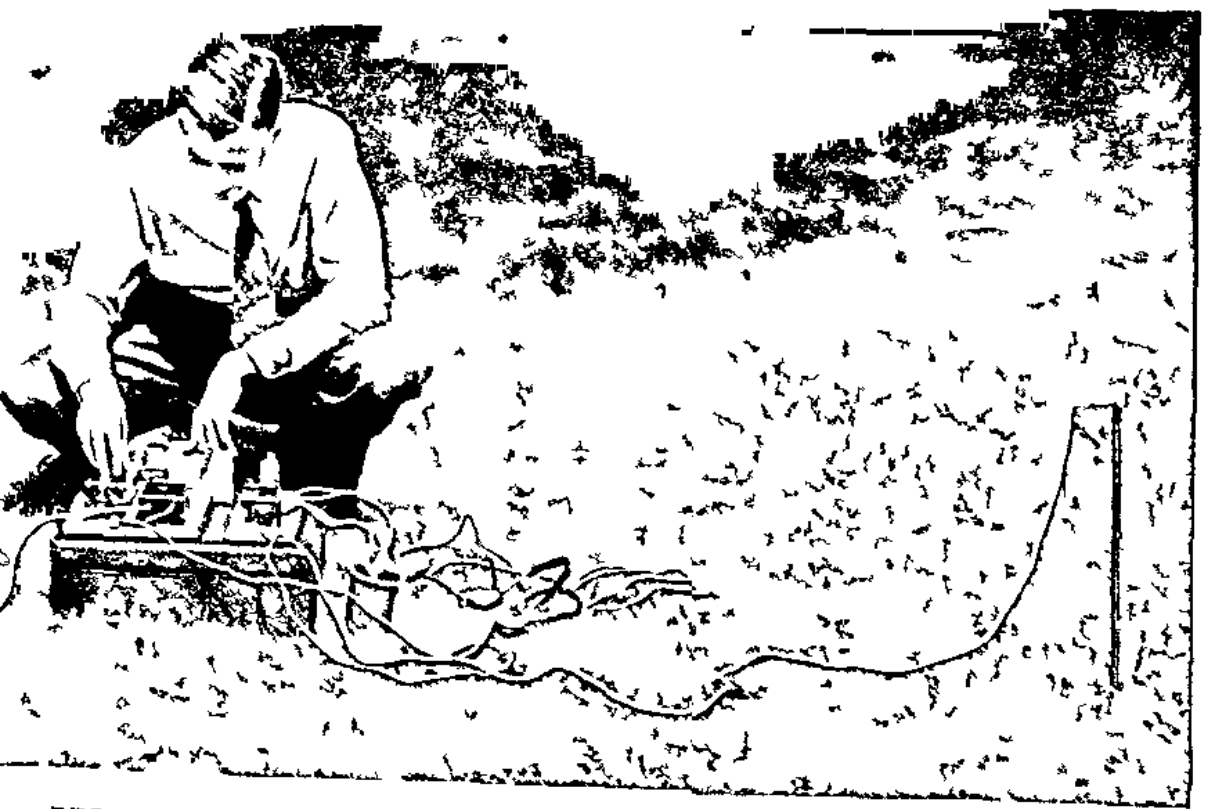


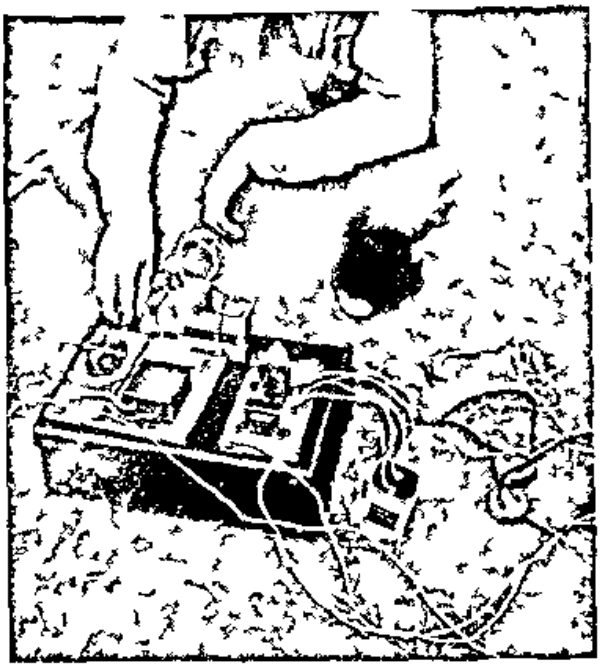


Method of Us ng Several Antenna Rods

a AN ENNA RODS
b AN ENNA CAB E

By FRANK TOBIN





A small suitcase provides a handy carrier for the outfit its batteries and the necessary wires

Get Started IN Radio

ALTHOUGH designed primarily as a phonograph amplifier for use with either a crystal or a magnetic pick up this fourth circuit in the Get Started in Radio series which began in the September 1940 issue is so versatile that it can be used for other purposes as well. Connected to a simple crystal receiver through a 3 to 1 ratio transformer for instance it can be used to provide loudspeaker volume on near by broadcasting stations Used with a microphone it can be made to serve as a small public address system.

The parts for the amplifier were all included in the main list of parts given in the first article If you bought the list complete you have nothing more to buy for even the baseboard can be used again by turning it bottom side up to conceal the holes that were made in mounting

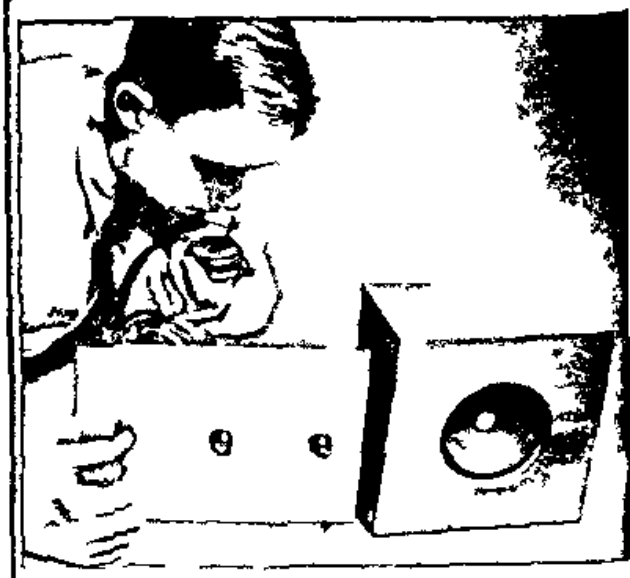
For the audio amplifier receiver a dual purpose 1D8GT tube is used The diode portion of the tube provides the first or input stage the pentode the second or output stage Notice that an audio transformer is used in the first stage and resistance coupling is used in the second

A small $1\frac{1}{2}$ volt flash light cell or an ordinary dry cell and one 45 volt B battery provide the current necessary to power the receiver circuit These batteries are indicated on the wiring diagram together with the socket connections

In setting up the receiver and transmitter be sure to follow the directions given in the drawing The antenna rods must be placed approximately 25 apart and in a line parallel to the line of the rods connected to the receiver If a greater distance of transmission is desired use additional antenna rods in the transmitter circuit and place them in open curves facing toward the receiver

PARTS FOR "AUDIO" TELEGRAPH

Amateur transmitting key
Bell transformer (see text)
House buzzer
Audio transformer 3-to-1 ratio
Baseboard octal socket.
Tube (1D8GT)
Fahnestock clips (eight)
Headphones 2 000 ohm
Antenna rods (four see text)
Mica condenser .005 mfd
Tubular paper condenser .002 mfd 600 v
Carbon resistor ½ watt 1 meg
Carbon resistor ½ watt 50 000 ohm
Miscellaneous Flash light batteries B batteries wire baseboards etc



An ear phone can be used as a public address mike

PART IV . . . A THREE-TUBE AMPLIFIER

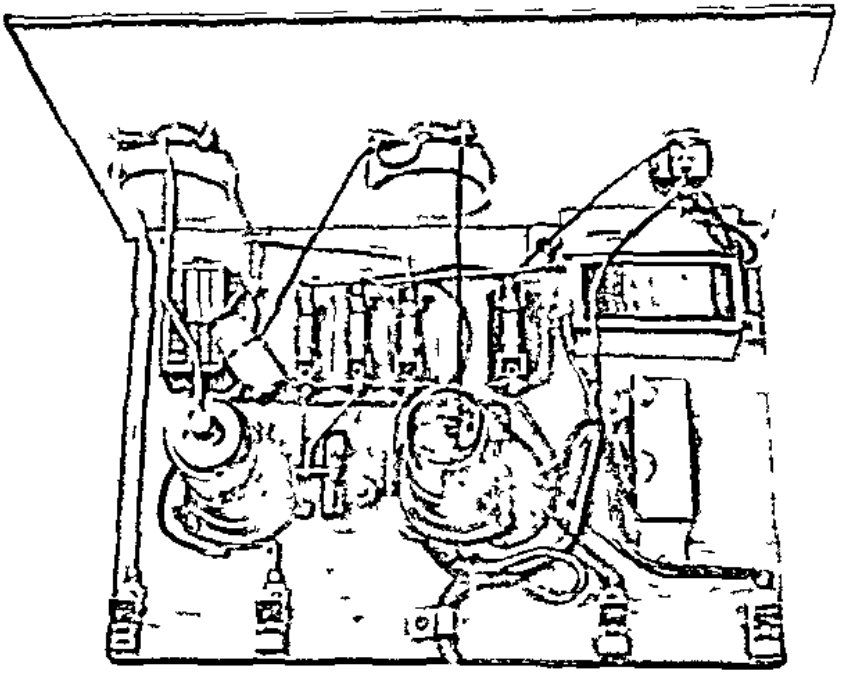
the parts for the first three circuits

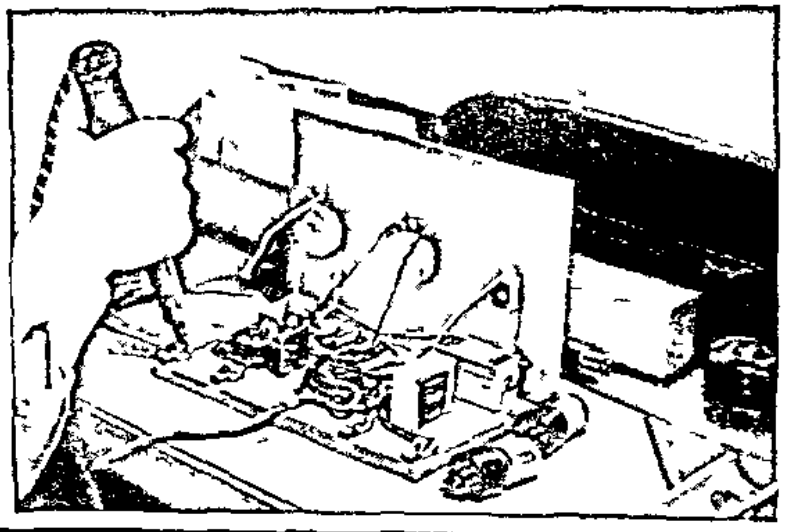
Your first job will be to take apart the four-tube receiver constructed last month. Be careful in removing the parts, as many of them will be used again.

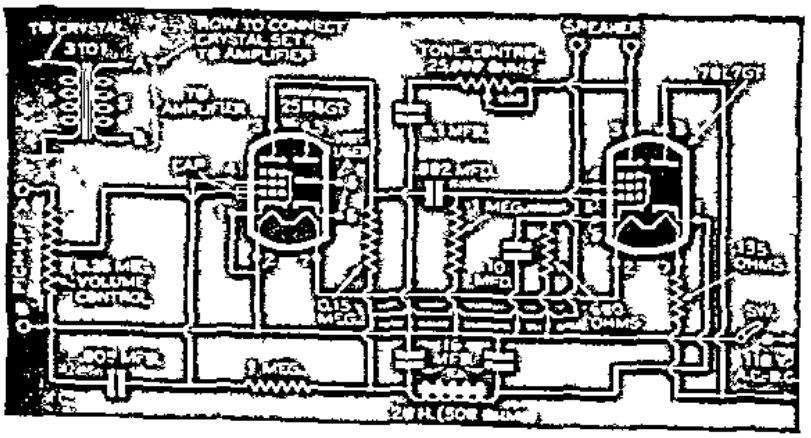
Both tubes (25B8GT and 70L7GT) are used in the amplifier circuit. The 25B8GT, not using its triode section, serves as the input stage and the 70L7GT provides the output. As shown in the diagram, resistance coupling is used and offers sufficient volume for ordinary use.

In placing the parts, follow the photographs. Mount the 25,000-ohm tone control, the 250,000-ohm volume control, and the on-off switch on the front panel The volume control fits conveniently in the space vacated by the variable tuning condenser used in the previous receiver circuits.

When used as a phonograph amplifier, the unit should be connected to a high-impedance pick-up with a rating of approximately 18,000 ohms.

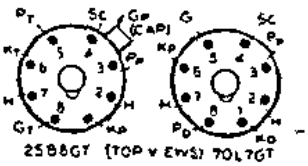






Soldering iron and pliers are the only tools needed to assemble the inexpensive amplifier

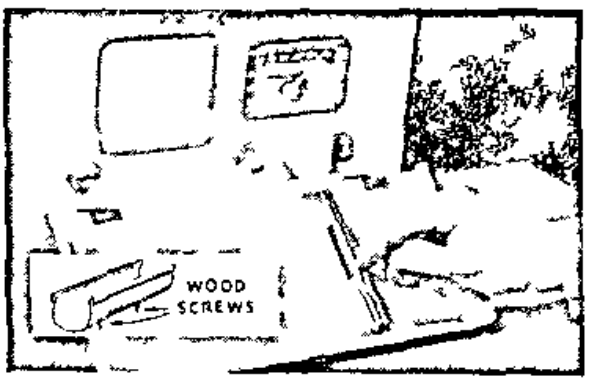
How the parts are wired. Below are the two socket wiring diagrams



NEW DEVICES FOR

Dial Light for Portable Radio

CONTROLS of battery powered portable receivers usually not illuminated can be bathed in light when needed if a small fountain pen flash light is fastened to an easily made clip screwed inside the cover





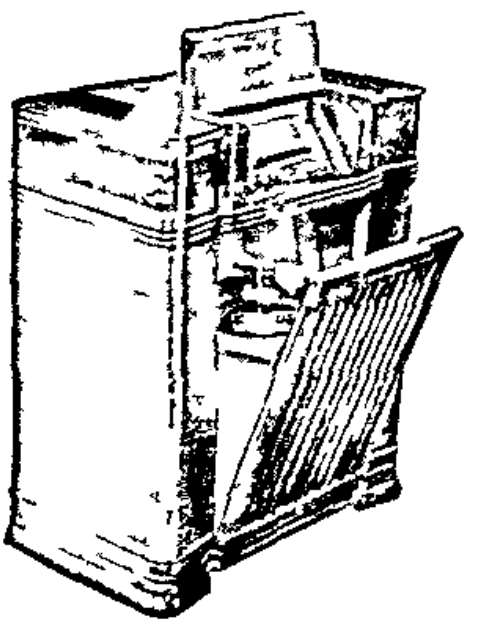
New Snap-Button Binding Posts

DRESSMAKERS snap buttons replace conventional plug terminals on a new light weight 67½ volt B battery designed to fit tiny portable radios Plus and minus buttons are reversed to prevent mistakes

Tilt-Front Radio-Phonograph Leaves Top Panel Free

HINGED at the bottom the entire speaker grille on the front of a new console model radio phonograph swings out drawing the turntable and pick up arm assembly forward to a position where records can be easily changed Besides making the phonograph accessible the design dispenses with the large hinged top frequently found on console type instruments and permits the top to be used for vases books and other decorative or useful objects Tuning controls set in a panel above the grille are revealed when a small double hinged lid is raised and folded back

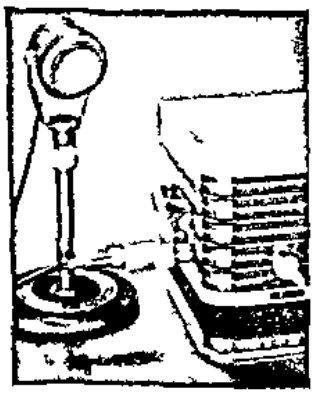


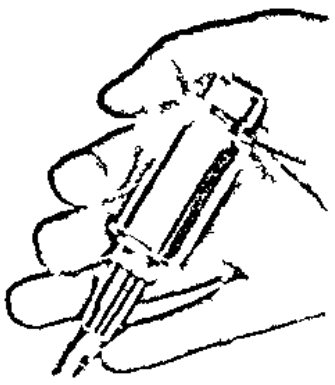


RADIO ENTHUSIASTS

Tiny Transformer Matches Microphone to Amplifier

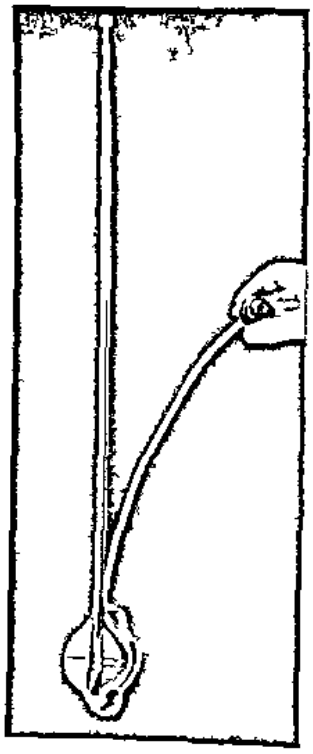
SCARCELY two inches long a new microphone cable transformer for public address systems at taches directly to the input of the amplifier when it is necessary to couple a low impedance mike with an amplifier having only a high impedance input Two types are available one having a 30 50 ohm primary and the other a 200 500 ohm primary Each unit is said to be completely shielded against hum pick up The compact unit uses a high permeability magnetic alloy core

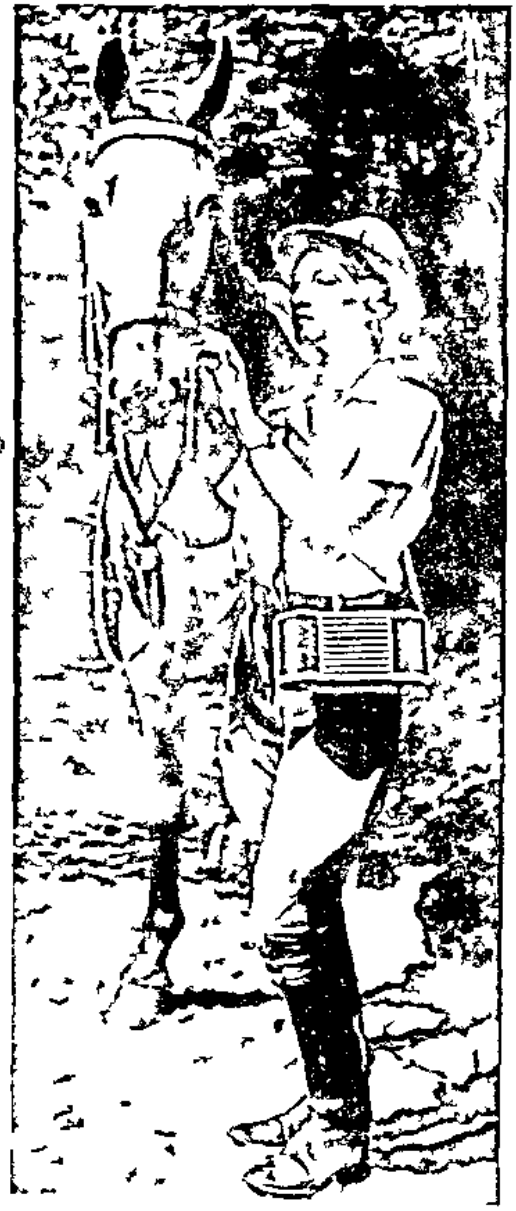




Knob on Dash Controls New Car Antenna

CONTROLLED entirely from inside a car the new telescoping car radio antenna shown at the right is easy to in stall and operate Avail able in several models for installation either on the metal strip divid ing some windshields or on a windshield pil lar or the s de of the cowl the antenna is controlled by means of a knob attached to the dashboard Turning the knob raises or lowers the antenna to the ex act height desired for peak reception.





Carrying Strap Is Antenna for New Midget Portable

WEIGHING only four pounds a re cently introduced portable radio re sembling a miniature camera is car ried by means of a shoulder strap containing a specially designed loop antenna The plastic cabinet houses a four tube superheterodyne receiver powered by a single long life battery A permanent magnet speaker pro vides good volume and tone

LATEST AIDS FOR



New Double-Purpose Reflector

HAVING a removable inner shell a novel photo flash reflector enables the user to choose between two types of illumination when he is making pic tures after dark or under poor lighting conditions. The reflector has a conventional outer shell of h ghly pol shed chrom um When it is used alone a de beam s given off by the reflector The inner shell w th a c rcular hole at the center has a rough satin finish. When th s aux l ary shell s in place the highly pol shed port on of the outer shell under the circular open ng reflects the l ght and throws a concen trated beam that g ves the same ef fect as a spotl ght.



Midget-Type Flash Bulb Comes in Handy Carton

PROVIDING a br ll ant stab of l ght, a new m dget w re filled photoflash bulb s now available to camera fans Only two inches h gh the l ttle lamps are sold n compact ten bulb packages wh ch can be carried in a coat pocket Each bulb s equ pped w th a bayonet base In the photo graph above one of the midgets is compared with a 1937 model bulb of the same brill ance The new bulbs are sc ent fically shaped to throw an even pattern of l ght.



Master Foot Switch

THREE outlets on the electr c foot sw tch at the left make t useful for many photographic jobs Two outlets in the top which are turned on when the treadle is pressed can be used to operate photoflood lamps or an enlarger may be plugged into one of them A third outlet, in the end is on permanently and is handy for a clock or safe l ght A red pilot light makes it easy to find in a darkroom

THE CAMERA FAN

Homemade Photo Match Books

HOMEMADE match books with favorite snapshots reproduced on the covers are now possible for any amateur who has access to a darkroom An eastern manufacturer has placed on the market sensitized cardboard books which can be purchased in quantities of fifty or more By contact printing the picture is recorded on the covers of the book After the photograph is fixed and dried the book is folded and the matches inserted



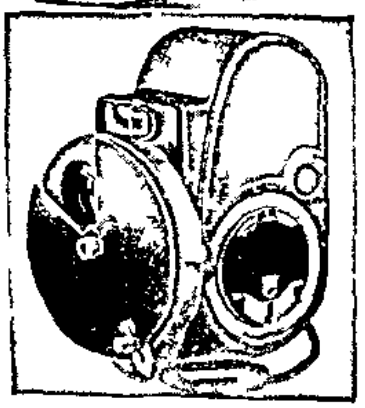
Any negative may be printed on these match covers





Water Runs Film-Tank Agitator

WATER does the work of rocking a developing tank to agitate the chemicals and insure even development when a new teeter-totter is placed under the stream from a kitchen faucet The tank rests on one end of the device while water flows into a troughlike compartment at the other When the trough fills the weight tips it down the water rushes out and the empty trough rises and is filled again The agitator made of acid resistant metal accommodates all sizes of roll film tanks

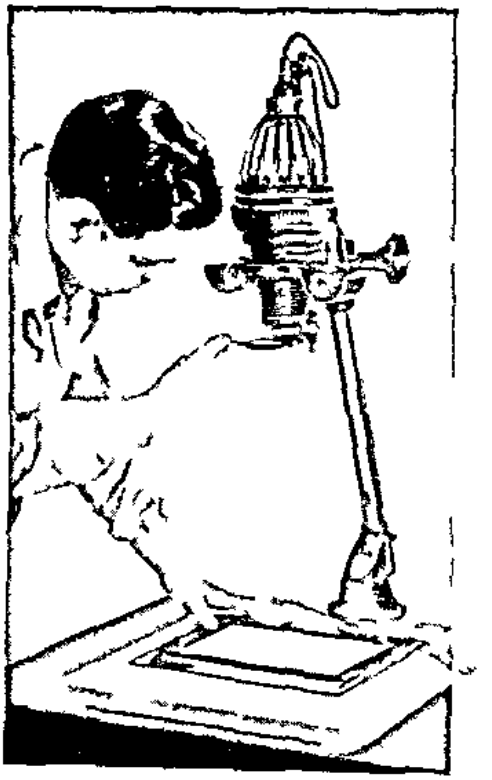


Graduated Disk Fades Movies

A ROTATING disk graduated from transparency to opaqueness enables the home movie maker to produce fade ins and fade outs Simply by turning the disk he decreases or increases the light reaching the film

Enlarger Lamp Also Serves As Safelight

COMBINING the duties of safelight and enlarger lamp a tinted bulb used in a recently marketed enlarger is in direct contact with the air thus speeding up the dissipation of heat and eliminating any possible damage to the film due to overheated metal in the enlarger housing The exposed red upper surface of the bulb gives off a light which according to the manufacturer will not fog even the fastest enlarging papers



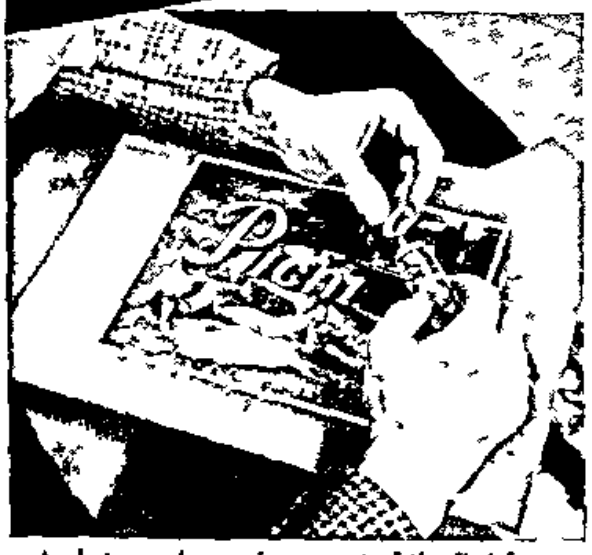
By JOHN H. WOOD



After the title is shot upside down a tiny peg is pulled away and the reel rolls down the slop ng track The film is turned around when it is spl ced in place so that the title appears to roll into view and then stop

Action Titles

PEP UP YOUR MOVIES



A photograph or enlargement of the first frame of a scene makes an excellent title background

TITLES containing or implying action do much to improve home movies, and making them can be just as much fun as shooting regular scenes. You can easily devise many ingenious titles your audience will be certain to appreciate

Taking a picture of a title upside down, then turning the piece of film around and splicing it so the action is reversed is an old trick, but one for which new variations are constantly being contrived by 16 mm movie makers Charles H Taylor, of Chicago, suggests two such variations

In the first, titles roll into the picture on movie-film reels To perform this stunt, support a yardstick across the back of two chairs placed before a plain wall and fasten pieces of cardboard to the thin edges of the stick. Let the edges of the cards extend above the surface of the stick about ⅛" so as to form a shallow trough for the reels The letters, which may be paper, metal, or plastic, are fastened to the reels with rubber cement, wax, or even chewing gum

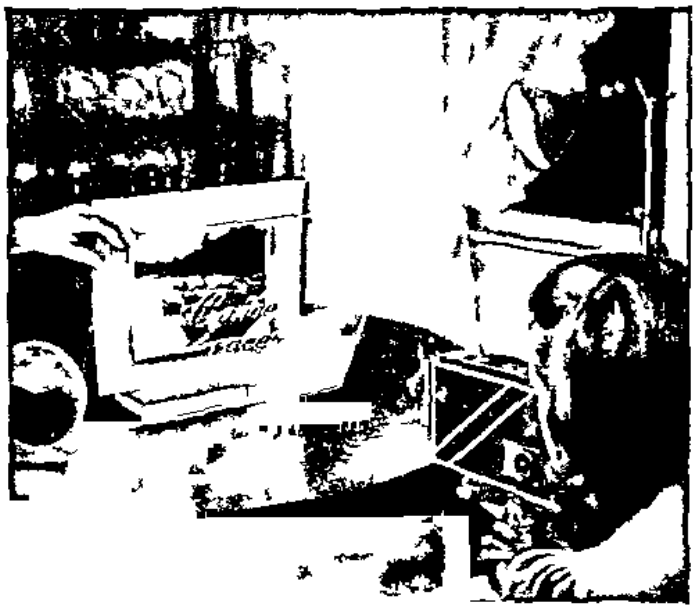
Place the reel or reels, as the case may be, so that the desired word or phrase is spelled upside down Elevate one end of the yardstick slightly and place a toothpick or pin tied to a thread in front of the reel Shoot the title long enough to record the word, then pull away the toothpick and the reel will roll out of the scene When the film has been processed, splice in the title backwards

Mr Taylor s second trick produces the effect of a revolving reel unwinding film that moves across the screen to spell out the title Support a large piece of cardboard across a doorway or between chairs as shown Starting with the first letter of the title push long pins through from the back so they go through the track perforations and hold the film in place The title must of course be upside down.

Wrap several layers of adhesive tape around a pencil so the reel fits on it tightly and can be turned from the back Arrange the lighting to cast shadows and thus give thickness to the letters Number the pins on the back of the cardboard so your assistant knows in what order to pull them Shoot the title long enough to be read then start removing the pins and winding the film onto the reel

Photographs magazine illustrations and even pieces of wall paper often provide appropriate backgrounds for titles Sometimes an exceptional effect can be obtained by using an enlargement of the first frame of the scene The audience then sees a title against an attractive background which suddenly comes to life when the words disappear Lighting of photographs must be done very carefully if they are to look realistic

A double exposure title can be obtained by printing (or typewriting) the wording on the back of a photograph made on single weight paper Illuminate the title from the

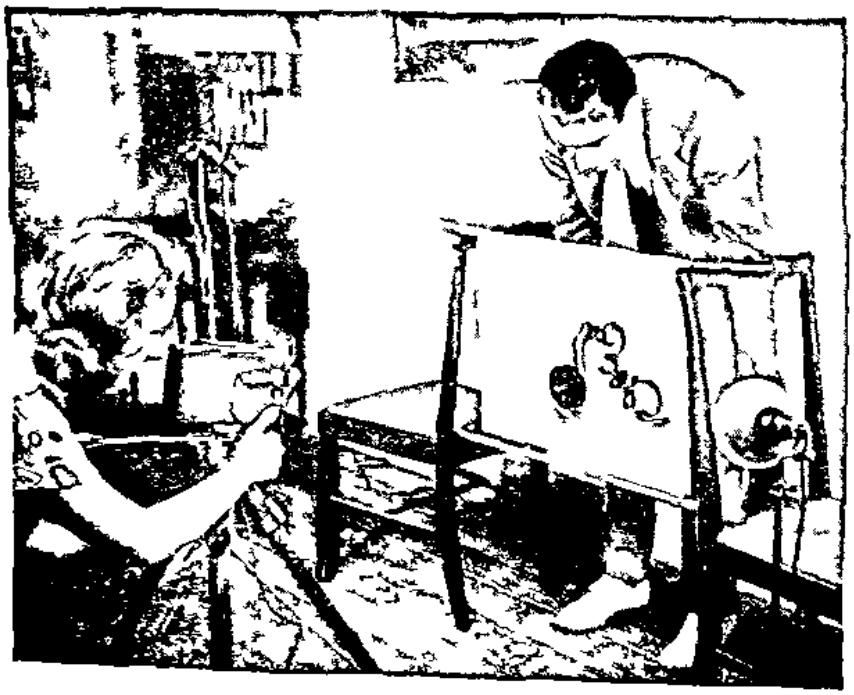


With this setup the picture is photographed then a title printed on glass is swung into position The words will be distorted until the glass is vertical Right action can be implied by a clever arrangement of the letters Here are three illustrations

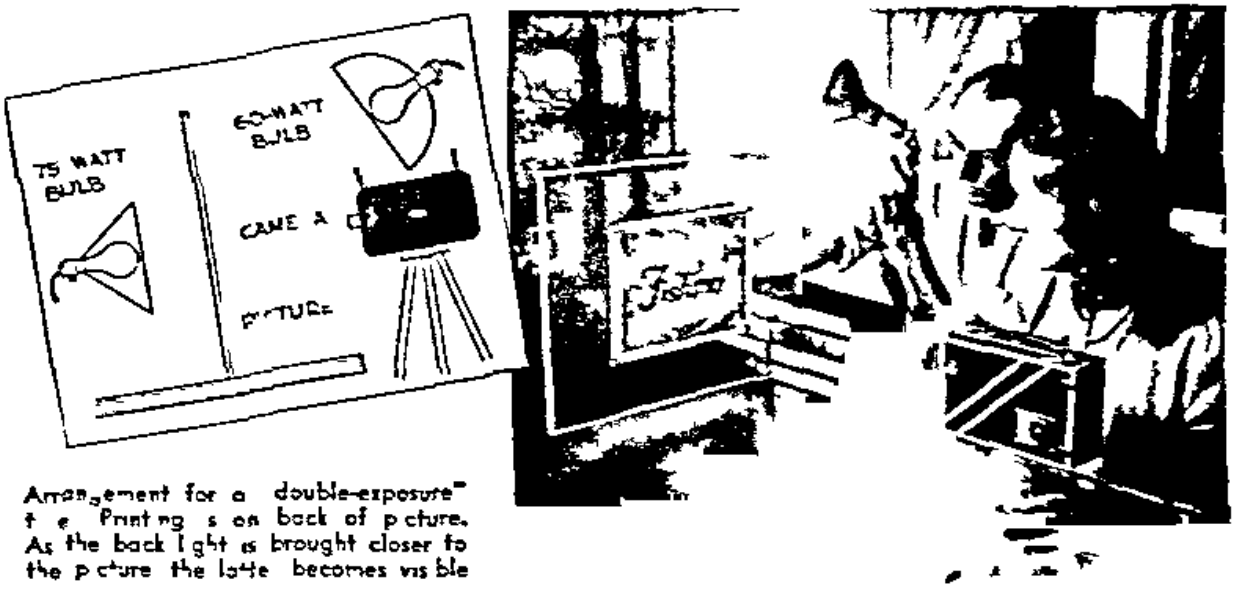








At left as the film is wound on the reel pins holding the letters in place on the cardboard are pulled from the rear



Arrangement for a "double-exposure" title. Printing is on back of picture. As the back light is brought closer to the picture the letter becomes visible

front and start the camera then gradually bring a brighter light up in back of the title so the picture shows through. With ordinary panchromatic film and an exposure of f/3.5 a 60-watt bulb in front and a 75-watt bulb in back of the picture should be sufficient. You can cut down the diaphragm opening by using photofloods. If you want to use an enlargement of the first frame of the scene as a background, the picture must be printed backwards.

The action in the scene to follow a title can often be implied by a clever arrangement of the letters. Several examples are shown.

If you letter the title on glass, actual scenes may be used for the backgrounds. First focus on the title then gradually bring the background into focus. Remove the glass and continue the scene. Another idea is to start photographing a picture then swing a glass with the title on it up into position over the picture.

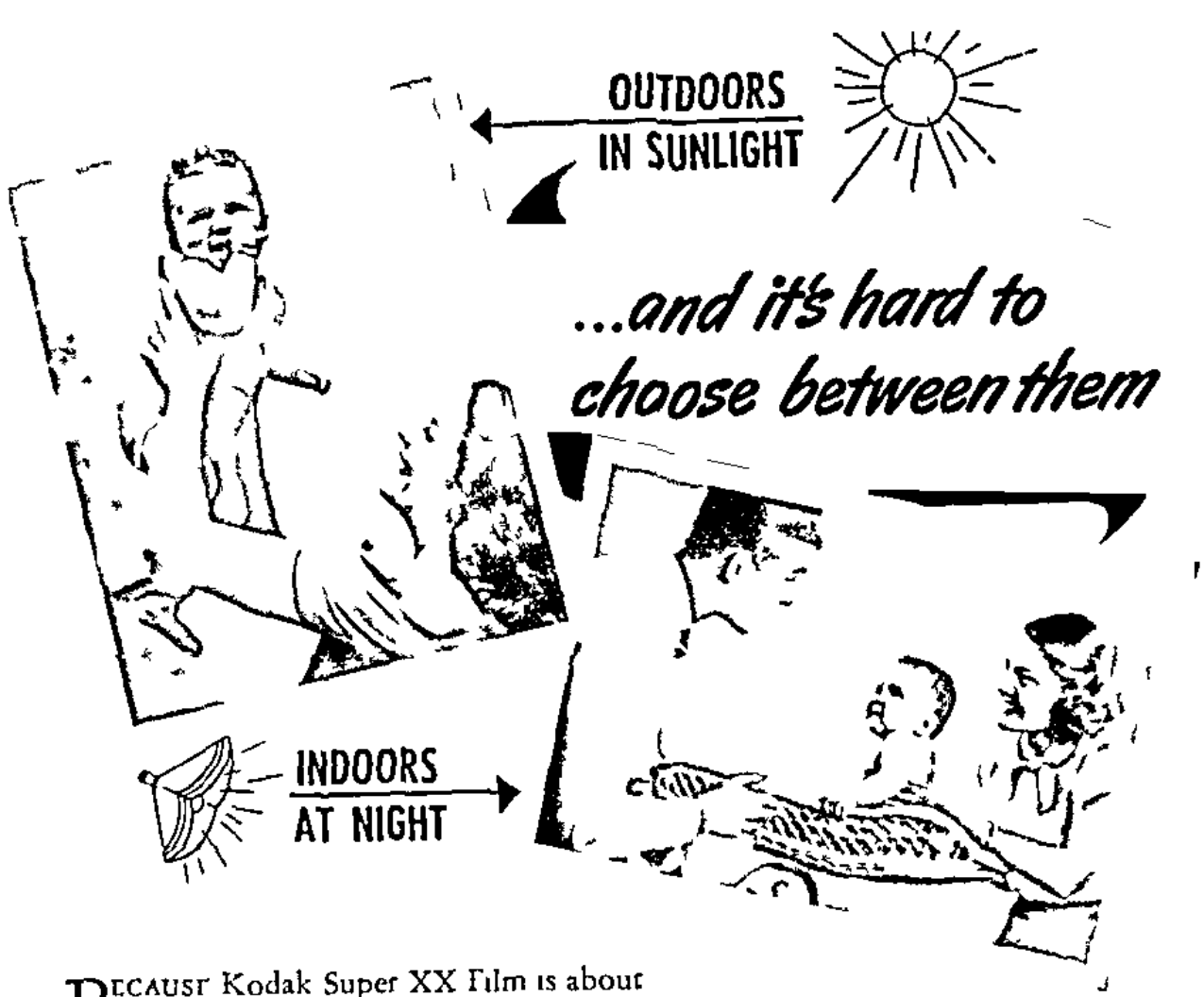
The stop-action technique has many applications. With this method, a single frame is exposed (the camera is set at half speed and the button tapped quickly) then a slight change is made in the scene a second frame exposed, another slight change made and so on. Toys can be made to move about, and people appear or disappear mysteriously. If this is done carefully smooth action will result. One movie amateur made a very amusing film on animals. The titles were written on a blackboard, and toys "pranced" about in front of each title.

FERROTYPE HINTS

[PHOTOGRAPHY]

Stale hypo baths containing exhausted hardening solution, cause much of the annoyance arising from prints sticking to the ferrotype plates. Do not use heat to hasten drying of prints on black enameled plates. A small piece of beeswax or paraffin, dissolved in a few ounces of gasoline is a cheap but good polishing solution. Apply with a small cloth, let dry to a matte surface then polish with a clean, soft cloth. Wrinkled prints caused by the wet prints pushing ahead of the roller may be avoided by placing a heavy blotting paper over the prints and holding it firmly while rolling. If short of ferrotype plates or time dry the extra prints face down on a towel after washing then resoak and ferrotype them later at your convenience. If prints are soaked for about five minutes in a ten percent solution of glycerin it will give them a more pliable "feel" and also reduce sticking and curling.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

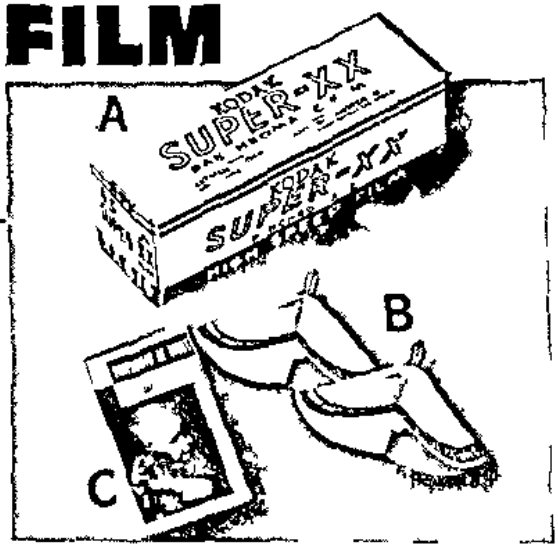


BECAUSE Kodak Super XX Film is about four times as fast as ordinary film it makes even a beginner and a $1 Baby Brownie a capable team for pictures at night Getting excellent snapshots under Photofloods in doors after dark is a matter of using the right film Be sure to load with Kodak Super XX Film You can then from the very first count on snapshots at night that are just as good as those you've been getting outdoors in the sun Any camera will do, just as long as it takes Kodak Super XX Film

NIGHT SNAPSHOTS

simple as ABC with

KODAK SUPER-XX FILM



A Load your present camera with Kodak Super XX Film

B Use a couple of inexpensive Mazda Photoflood lamps in Kodak Handy Reflectors

C Follow the few simple directions in the FREE Booklet

A few minutes with this helpful booklet and you're headed for splendid nighttime snapshots Photos diagrams easy to understand directions At your dealer's Eastman Kodak Company Rochester N Y

YOU NEVER SEE HIM—BUT SKILL FLIES WITH



THE ARMCHAIR above is his cockpit—but Bill Miller flies as many as 100 planes a day North south east and west from New York's LaGuardia Field (*air view right*) his radio control room directs the flying course of *American's* giant flagships

Flier navigator engineer traffic executive all in one—yes flight superintendent Bill Miller is a man with the extras—a man who *gets* the smoking extras too in Camels

For Camel's costlier tobaccos and slower way of burning give you more than mildness—they give you extra mildness and coolness with a flavor that holds its appeal right through the last extra puff Camels also give you extra smoking per pack (*see right*)

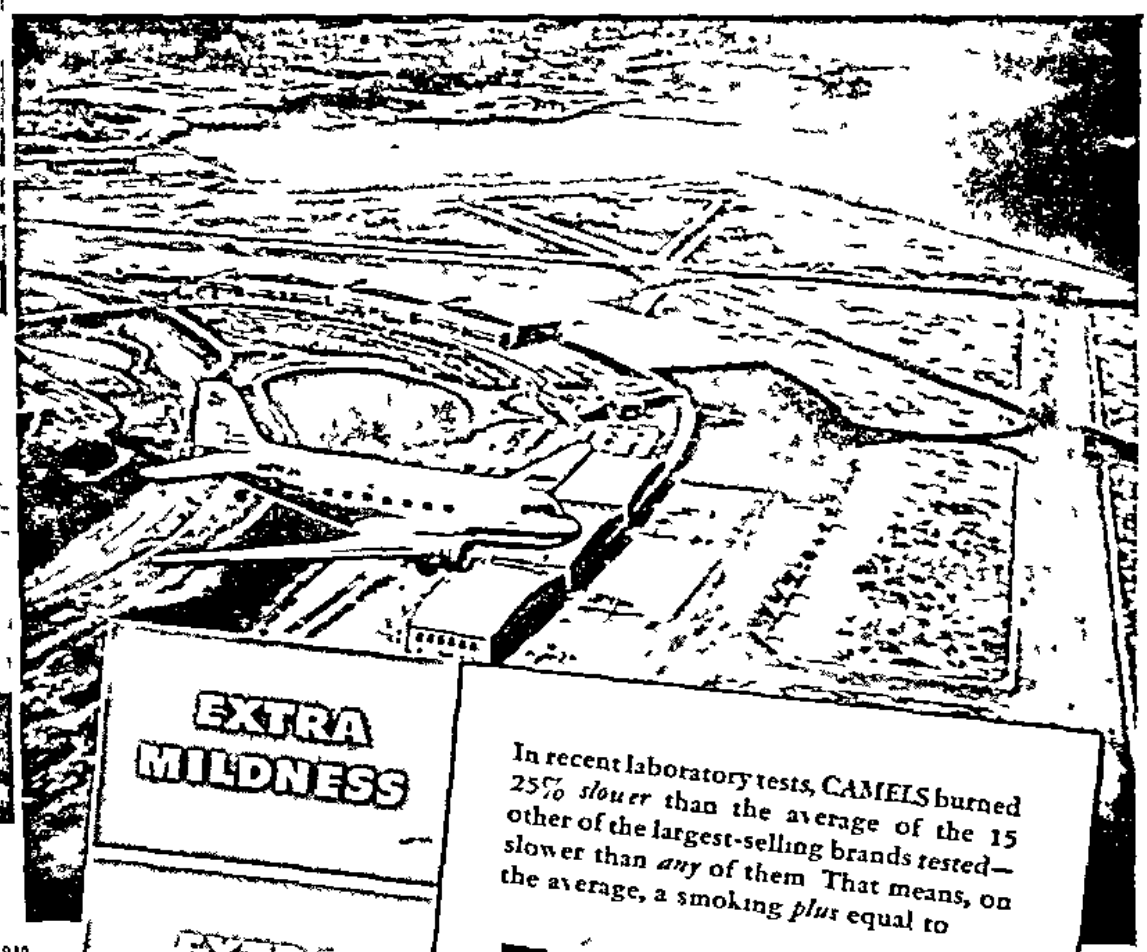
GET THE "EXTRAS"—WITH SLOWER-BURNING

CAMELS

THE CIGARETTE OF

IS EXTRA
OU EVERY MILE!

WILLIAM H. MILLER—Flight Supt., American Airlines



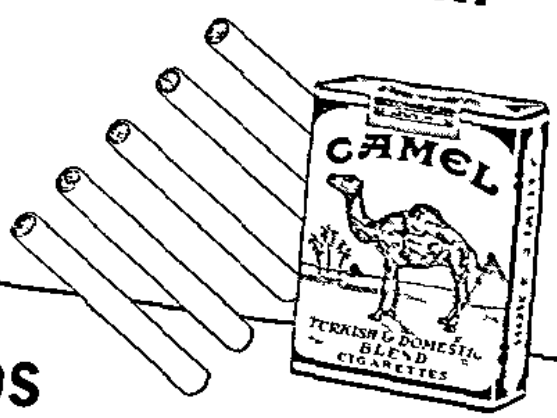
EXTRA MILDNESS

EXTRA COOLNESS

EXTRA FLAVOR

In recent laboratory tests, CAMELS burned 25% *slower* than the average of the 15 other of the largest-selling brands *tested*—slower than *any* of them That means, on the average, a smoking *plus* equal to

5 EXTRA SMOKES PER PACK!



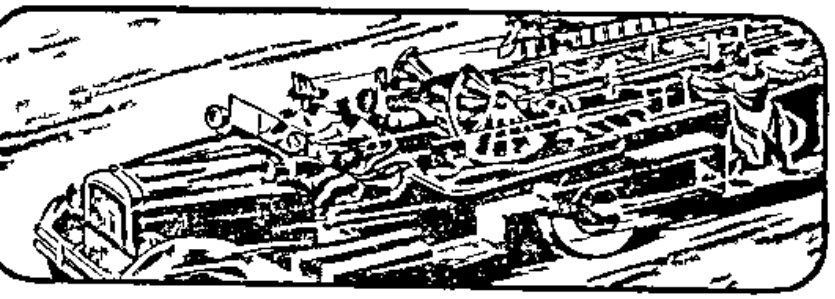
vright 1940
Reynolds
cco Company
ton-Salem
th Carolina

OSTLIER TOBACCOS

When you've got to get there—depend on

"PRESTONE" Anti-freeze

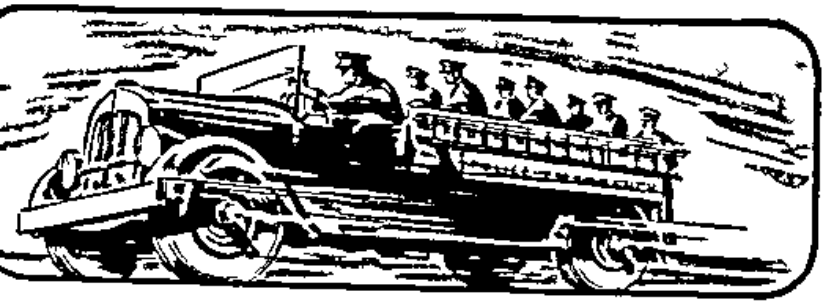
TRADE-MARK



Fire Departments use 'Prestone' brand anti freeze because it will not ful It has proved itself in more cars than any other l rand of winter protection ever made!

mbulances and doctors' ars get there with Pres one anti freeze the inter protection that ban lies freeze up, boil away, aming fumes, rust and orrosion One shot lasts l winter!



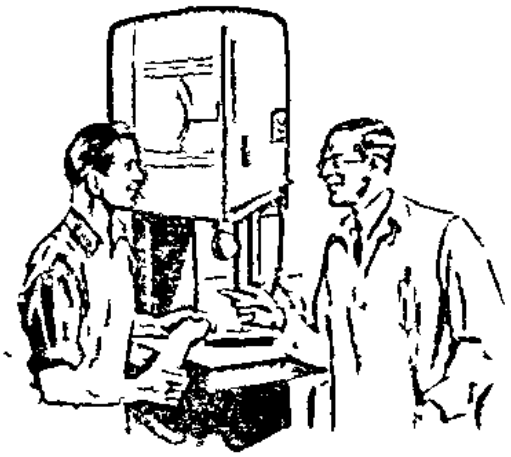


olice Departments rely on Prestone anti freeze do the armed forces of the United States Govern ent Prestone anti freeze is made to an *exclusive* rmula GUARANTEED IN WRITING See your dealer

e words Presto e and E e ea l are registered trade marks of Nat o al Carbo Co pany Inc



"YOU'RE SAFE AND YOU KNOW IT"



Old Bill says . . .

A RECENT TEST given six toolmakers to determine the exact size of a commercial gauge in ten-thousandths, with all men using the same micrometer resulted in six different dimensions. Precision without skill is going to be one of industry's problems for some time.

• • •

Some means to filter the compound is imperative to meet today's cylindrical grinding requirements. It is the only way to avoid those lines which, although quite invisible to the naked eye, detract from the perfection of the finish.

• • •

If I were forced to decide on a certain construction of die set, among the various designs, I should select one with two leader pins placed diagonally.

• • •

Since spot welding is so commonly employed and the necessary equipment is now so reasonable in cost, why not use more cheap steels for shanks of end mills, counterbores, reamers, and the like?

• • •

It is modern practice to bevel the end of a plug gauge and grind a 1/4" width 0.001" under size. This is a safety measure for both gauge and operator.

• • •

The proper metal cutting band saw in a good, modern machine will cut 1" thick tool steel, cold-rolled, and cast iron at the rate of 1", 1 3/4", and 3 3/4" per minute, respectively.

• • •

Two bench-type, automatic-feed threading machines, side by side, prove profitable for identical thread production or when a part involves two different pitches, or a left- and a right-hand thread. The operator need take but one step to load one machine while the other cuts.

• • •

The latest technique in threading rough alloy steels with chasers, generally speaking, is a 10-deg. chamfer angle, 10 percent more face grind than formerly used, together with the highest quality lubricant, and the highest speed that will not generate heat.



• Motorcycling opens up a whole new world of fun and excitement for you. And a 1941 Harley Davidson will make your dreams of thrills and adventure really come true! Glorious zooming power and rugged dependability to take you any place you want to go — anytime. Yes, and plenty of good times with other riders on club runs and gypsy tours, at races, hillclimbs and other exciting events. See your Harley-Davidson dealer — get the thrilling story of motorcycling, the world's greatest outdoor sport, and ask about his Easy Pay Plans. Mail coupon NOW!



FREE

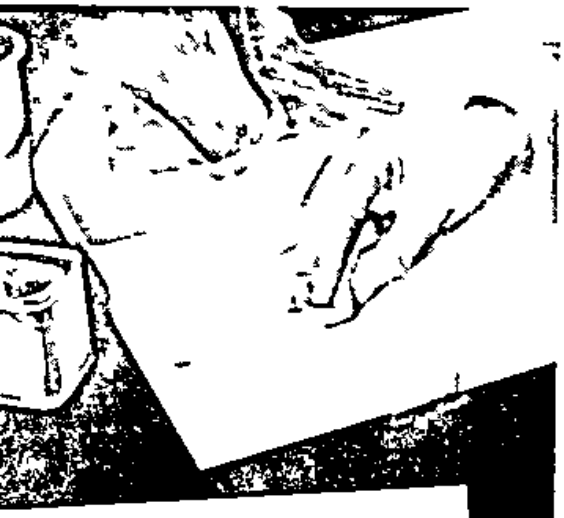


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WORLD'S *Champion* MOTORCYCLE

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Dept. PS Milwaukee Wisconsin.
Send FREE copy of big 24 page "Enthusiast" magazine filled with thrilling motorcycle pictures and stories. Also literature on the 1941 Harley Davidsons. Stamp is enclosed for mailing cost.
Name _____
Address _____

SHORT CUTS FOR THE HOME CRAFTSMAN



How to give a good rub down!

● Fine abrasive powder mixed with water or oil can be used to rub down final coats of enamel lacquer or other material, to produce an even texture or special effect This is only one of the many polishing operations you can do by mixing a little Carborundum Brand Silicon Carbide or Aloxite Brand Aluminum Oxide Powder with water or oil, and rubbing the work with it.

The illustration shows how to rub down a sprayed lacquer surface. Use a cloth or felt pad and reduce the pressure towards the end of the finishing operation Then polish with a woolen cloth This produces a fine satiny gloss Many more helpful hints are given in the booklet offered below

Ask your hardware dealer or mill supply house to show you the complete line of Carborundum made coated abrasives, sharpening stones grinding wheels and other abrasive products for the home craftsman Send 10c coin or stamps for souvenir sharpening stone and valuable illustrated manual on how abrasive products can save time and help you do better work.

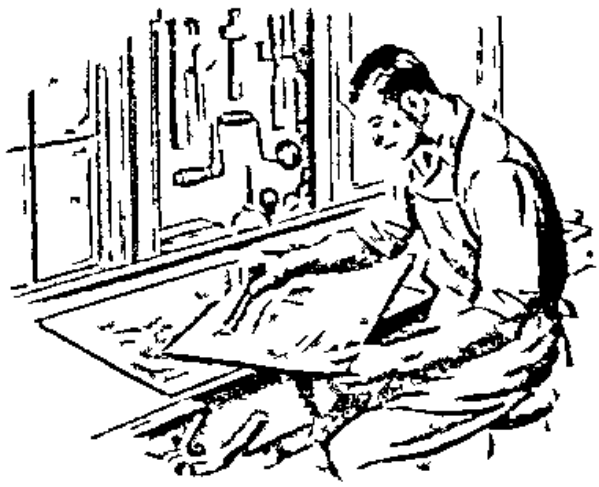
CARBORUNDUM

Write Dept S 120

CARBORUNDUM COMPANY

Niagara Falls, N Y

[Carborundum and Aloxite are registered trade-marks of and indicate manufacture by The Carborundum Company]



Blueprints

Solve Your Gift Problems

GIFTS you make in your home workshop are always prized a great deal more than those bought at a store Whether you want to construct furniture, toys models photographic equipment, or novelties our plans will help you. The blueprints themselves make excellent gifts for men and boys who like to make things, and those marked with an asterisk (*) in the list below are particularly well suited for this purpose Approximately seventy-five suggestions are given. Our complete blueprint list will be sent free upon receipt of a self addressed stamped envelope

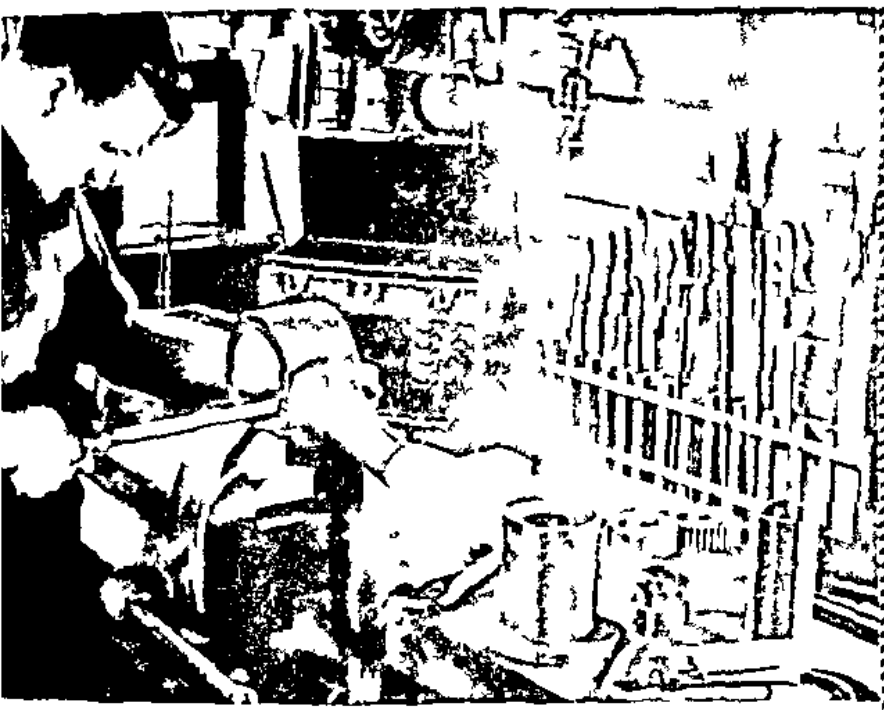
GIFTS FOR MEN

*Cabin Cruiser 17 long weighs 750 lb for use with inboard or outboard motor from 2 to 10 h p 356 35 358 3 9 R $1 50
*Clipper Ship Model GREAT REPUBLIC 31½" hull 2 2 2 3 2 4 R 1 25
*Family Runabout 13 5½" long weighs 2 5 lb for outboards from 1 to 60 h p 3 8 S 379-380-R 1 50
Folding Duck Boat 13 long 1 0-R 50
Magazine Rack and Wooden Wastebasket 296A 25
*Racing Sailboat BLACKCAT 13 4 long weighs 250 lb Marconi rigged 321-322 323 R 1 00
Sandpaper Cabinet Sawhorse Hand Screw Rack Tool Rack and Machinist's Hand Vise 368A 25
Smoking Cabinet 2 25
Special Bookcase for copies of Popular Science Monthly 3 3A 75
*U S Battleship TEXAS 3 long 197 198 199-200 1 00
Utility Rowboat 13 long 21 R 50

GIFTS FOR WOMEN

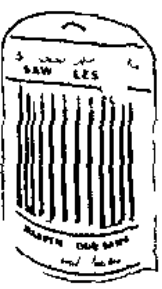
Combination Magazine Rack and Foot Rest Paper Napkin Holder and Key Rack 264A 25
End Table American Empire 241A 25
Gate-Leg Table 24 25
Kitchen Table Cabinet 27 25
Meltta Toast Slicer Plywood Refreshment Tray Memo-Pad Picture Frame and Copper Flower Pot Stand 392A 75
Mirror Frame 246A 25
Modern Bedside Cabinet has automatic light in top drawer 394A 25
Modern style Folding Screens 91 25
Mosaic Serving Tray 29 A 25
Queen Anne Dressing Table Stool and Mirror 295A 75
Sewing Cabinets Priscilla and Modern 31 25

(Continued on page 222)

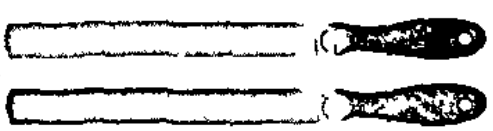


A mechanic is known by the tools he uses

WOULD YOU be proud, or embarrassed to show a prospective employer your private workshop or work bench — where you "experiment" build models "gadgets," practical devices keep household equipment in repair where you add to your mechanical training toward greater earnings? • Begin with your files Are they cheap little known brands? Are they battered and worn? Nicholson and Black Diamond Files are the pride of skilled mechanics Their superior performance far outweighs their small extra cost. • Nicholson — largest file manufacturer in the world — makes more than 3000 kinds, sizes and cuts of files, including many special purpose files—such as Die makers, Aluminum Die Cast Brass Foundry, Long Angle Lathe and Stainless Steel Good hardware and mill supply dealers carry a practical variety



THESE USEFUL FILES



are now being widely featured by hardware dealers *Left—SLIM TAPER SAW FILES* (triangular) for hand-saw sharpening and many other uses. *Above—HANDY FILE*—two files in one Single cut on one side double-cut on the other—for both smooth and rough filing jobs Regular flat handle Files Cellophane wrapped Both these items obtainable in either Nicholson or Black Diamond brand



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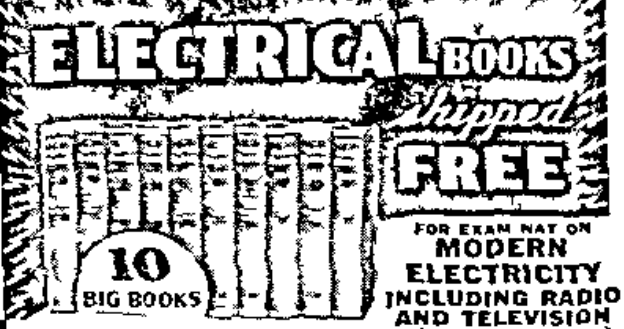
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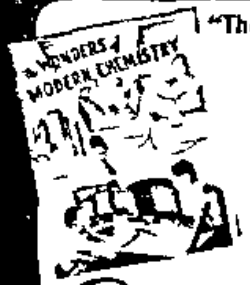
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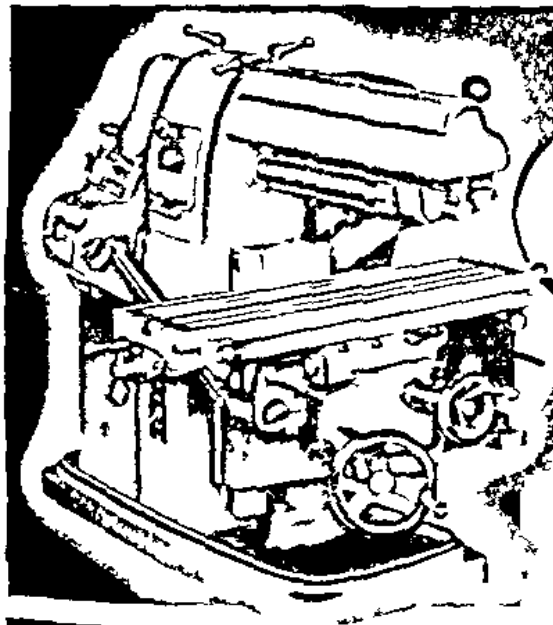
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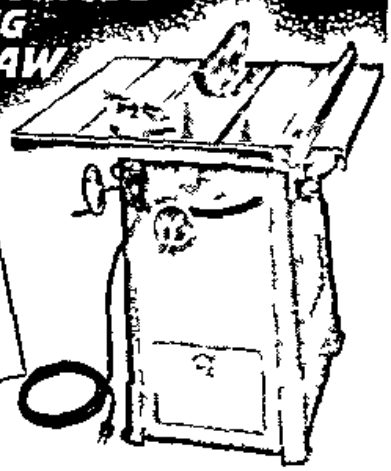
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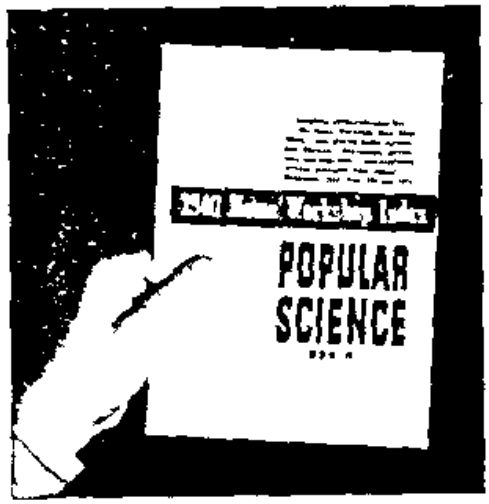


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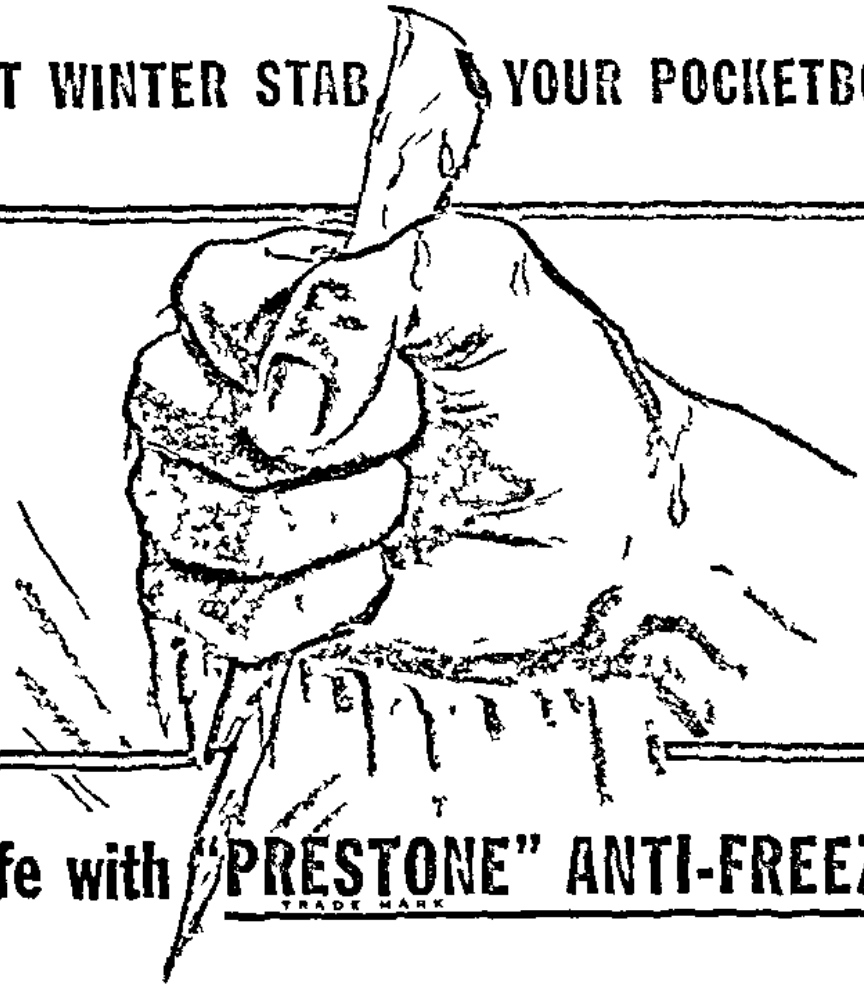
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The paraffin can be removed by gently warming the side of the jar or can under hot water and lifting out the disk of paraffin with a nail or pointed stick.—H. T.

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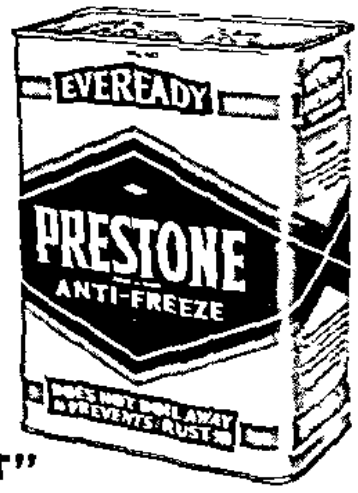
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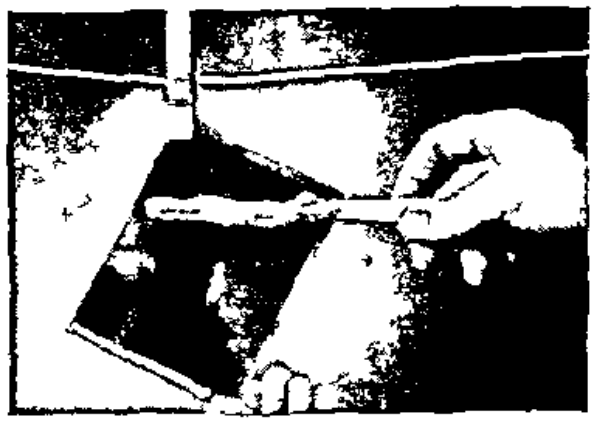
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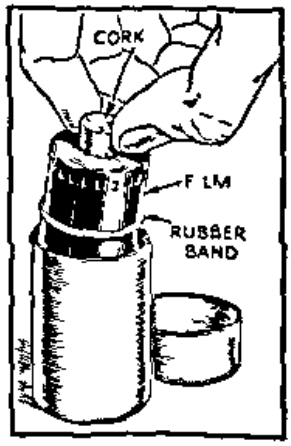
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How to Wipe Wet Negatives Without Scratching Them

ALTHOUGH cotton is often used for removing excess water from negatives swabbing them with tufts of cotton held in the fingers may cause scratches on the soft emulsion. A better method is to wind the cotton around a tapered dowel as shown The wet cotton adheres to the stick.



Film Handle

MINIATURE 35 mm double frame film may be stored conveniently in the original cans without danger of finger marking or scratching if it is first rolled around a cork and secured with a rubber band. The cork serves as a handle

Unbreakable Stirring Rods

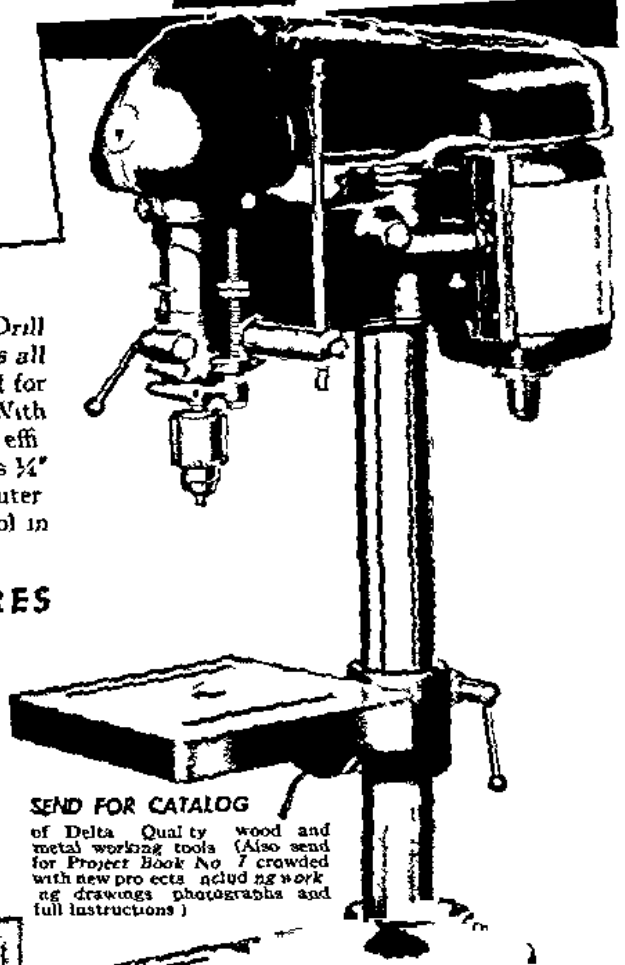
RODS for stirring and crushing photographic and other chemicals can be made from ordinary five cent plastic penholders Cut a short piece from the large end of each in order to remove the portion that is drilled out. These stirring rods will not break and are not affected by the chemicals.



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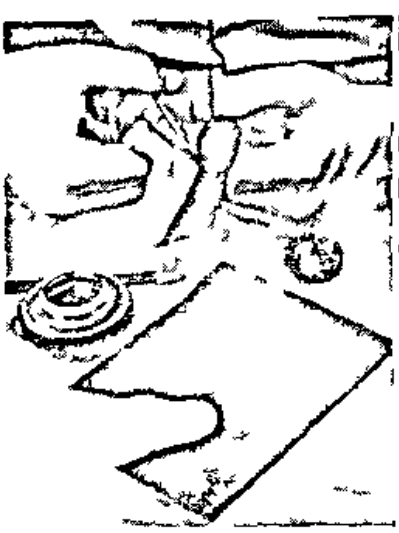
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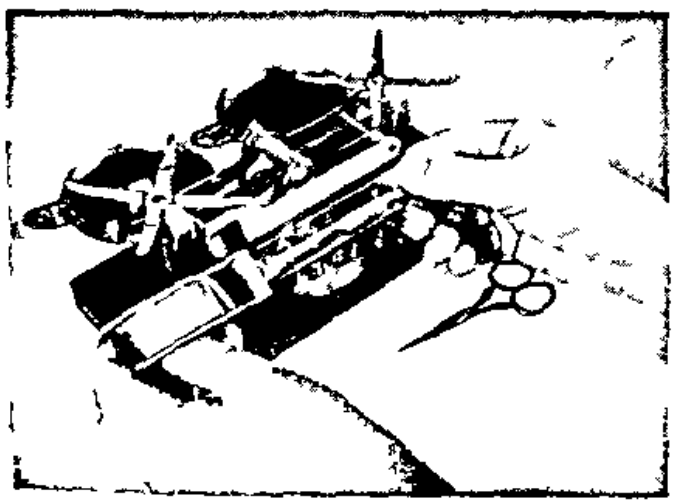


Pinhole Iris

PHOTOGRAPHS of extraordinary depth of focus can be obtained by inserting a pinhole iris between the front and rear elements of certain types of camera lenses The sculptured figure ornament in the upper right-hand corner of the accompanying night scene was about two feet from the camera yet it is as sharply defined as the distant buildings and lights in uptown Manhattan

New York night scene taken through a pinhole iris used with a Zeiss Tessar Anastigmat lens, 15 minutes on Super XX film

To prepare the camera the rear element of the lens was unscrewed a disk of black paper was cut out the same size and the center was pierced with a fine needle The disk was dropped into the lens barrel and held flat by replacing the lens element This in effect provided a new diaphragm stop equivalent to f/531 The lens used was a Zeiss Tessar Anastigmat f/4 5



TAPE PROTECTS FIGURES ON A DARKROOM SCALE

AFTER a darkroom scale has been in use for a time the division marks and figures engraved on the beam are likely to become indistinct because of unavoidable corrosion caused by some of the chemicals used This can be prevented by covering the face of the beam with a strip of transparent cellulose tape, which will not interfere with the movement of the sliding weight. If the tape becomes worn it may be replaced with a new piece —K. M.



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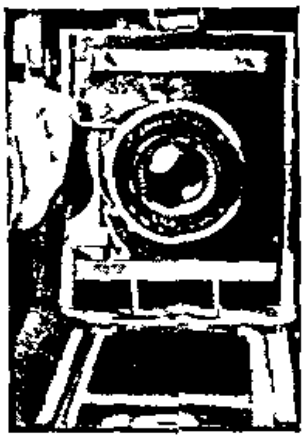
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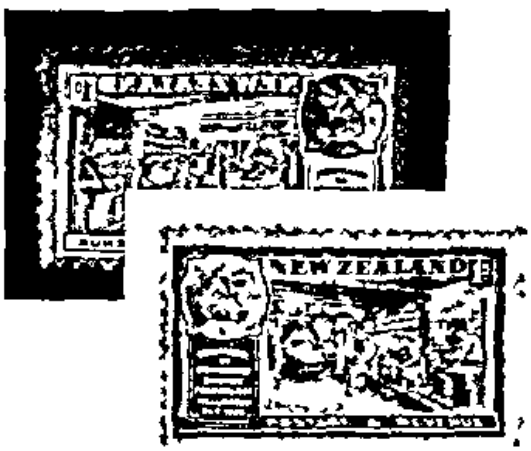
Looped Wire Prevents Loss of Camera Cable Release

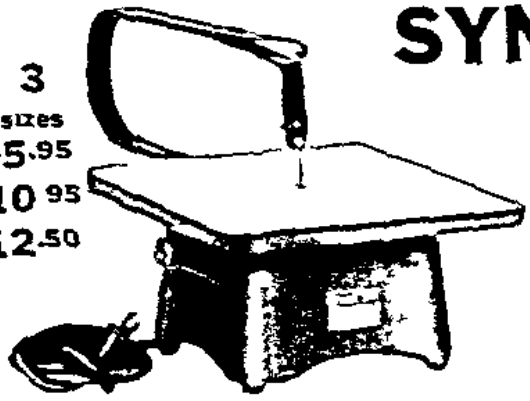
MANY a photographer has suffered the loss of a cable release After one such experience sixty miles from the nearest camera store I determined it would never happen again I simply made a loop on the end of a wire large enough to fit the body of the cable release but too small to slide over the metal end The wire was then passed around the barrel of the lens and attached to itself by another loop The attachment is shown in position at the left Any type of wire that is thin and strong may be used for this —F C



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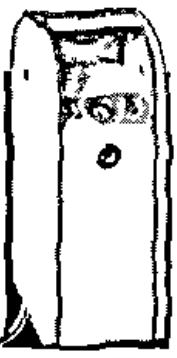
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He Invented the World's Deadliest Rifle

(Continued from page 71)

meeting was an offer to turn Garand loose in a room at the Bureau of Standards and let him prepare a working model of his gun The salary was just half what he was receiving as a skilled machinist. But he jumped at the chance

For eighteen months Garand buried himself in the room set aside for him At the end of that time his gun was finished But so was the World War and the demand for machine guns was at a standstill However, the U S Army had become interested in developing a light, semiautomatic rifle a sort of compromise between a machine gun and a Springfield rifle Garand moved to the Armory in Massachusetts and tackled the job

That was twenty-one years ago Ever since, the struggle to make this radically new weapon simple enough strong enough, and light enough, has continued These three problems were in the back of Garand s mind night and day—when he was working, lying in bed, playing table tennis or badminton or horseshoes Often he came down to the Armory on week-ends and in the quiet of the great brick buildings wrestled with the toughest riddle of all, cutting weight to a *minimum*

There were many times when Garand was positive the weight requirement set by the Army could never be reached Eventually, by saving an ounce here and an ounce there without sacrificing strength, he attained the goal Most of the weight elimination was accomplished by reducing the number of parts For example, one spring in the hammer mechanism now does the work that originally *required* five springs That mechanical short cut, alone clipped a whole pound from the weight *of* the gun Gas pressure produced by the discharge *of* the cartridge automatically ejects the shell and cocks the gun, so all the operator has to do is pull the trigger In other words, Garand has put the 'kick' to work and by so doing has given American soldiers the best high-speed firearm on earth.

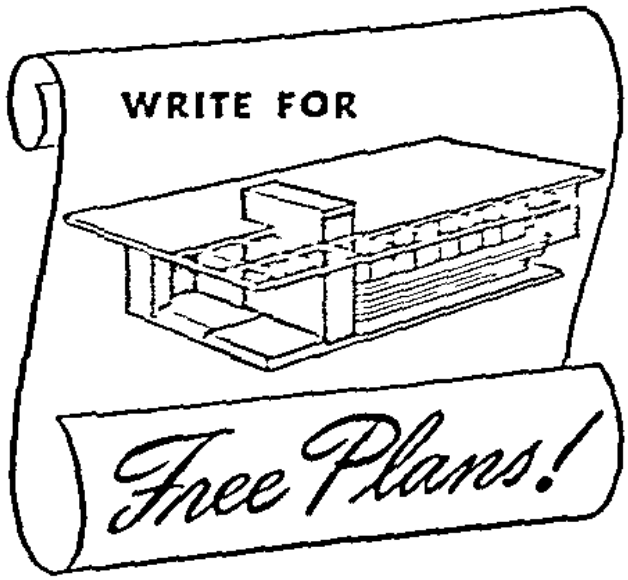
Along the road to this goal model after model was designed and worked out with infinite care *only to be* rejected after grueling tests Nearly a dozen kinds of gun steel were tried, and the rear sight alone was redesigned fifty times The present Garand gun combines the best features of half a dozen discarded designs All during these years other inventors were bringing forth ideas in

(Continued on page 236)

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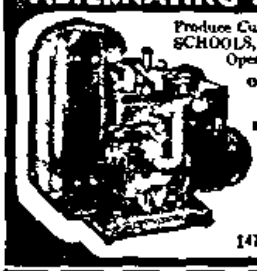
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He Invented the World's Deadliest Rifle

(Continued from page 235)

competition with the rifle Garand was making His weapon won out over approximately fifty different models which were suggested or submitted to Army experts.

In those last hectic days when the Armory was rushing through a batch of the new guns for large scale tests the workmen labored in two shifts night and day Garand worked both shifts sleeping when he could Then came the most strenuous tests ordnance experts could devise The gun was fired almost continuously far beyond the limits of ordinary use It was soaked in water and thrown in mud It was even placed in a sand blast machine for hours to see if any of the quartz grains would penetrate the mechanism The rifle passed these torture tests with flying colors

Garand has turned down tempting offers from a commercial company and a foreign government in order to give the United States exclusive rights to manufacture his rifle For the price of one destroyer the whole U S Army can be equipped with the superguns

This then is the story of the man behind the Garand rifle—the story of a former motor cycle racer crack shot, boy inventor and toolmaker who without benefit of a formal education or an engineering degree made firearms history His two decades of concentrated application have produced a weapon which promises to be of outstanding importance in American defense

"Miracle Measure" Gauges Thickness of Rust

Thickness of rust or weathering on sheets of iron can be measured to less than a hundred thousandth of an inch by a method developed recently by the Bell Telephone Laboratories in New York City A short iron rod with two coils of wire on it is pressed end on against each side of the coated iron sheet Both rods are magnetized by passing an alternating electric current through one of the coils on each rod. This induces a current in the other two coils The coating which is nonmagnetic reduces the induced voltage on its side of the sheet by an amount that depends on the thickness of the coating The method can also be used to measure the thickness of coatings of paint paper or other nonmagnetic materials It is done without disturbing the coating

Gus Gets Ready for Winter

(Continued from page 150)

to get a trunk tag and write on it and then tie it on your filler cap so that gas station attendants won't add unneeded water If you do any long-distance driving during the winter, you should have your radiator level checked about once a month"

'I know those $2 65-a-gallon antifreezes are good, Ez said But how about the cheaper ones? A feller was tellin me the other day that he only pays a buck a gallon, an' that the stuff does the work

"Antifreezes are like most other things —you get just about what you pay for," Gus replied The base of most of the dollar-a-gallon mixtures is high-test methanol —wood alcohol—with something in it to prevent rust and corrosion But methanol evaporates—which means that you have to keep watching your mixture, and keep adding to it"

'How about plain alcohol?" Ez wanted to know 'We always used to use it, and it did the trick,"

"It will keep water from freezing, all right," Gus said 'But engines run hotter now than they did only a few years ago, so plain alcohol is likely to boil away The only advantage it has over the antifreeze mixtures is that its first cost is lower—but you have to add to it so often in the course of the winter that in the end it costs you as much as the made up mixtures, and you have a lot more bother with it."

Joe Clark's voice came from the office 'Hey, Gus Send Harry over to the golf club with the wrecker And Mrs. Miller says—darn that telephone!"

Gus grinned "Time to go to work!" he said

Ez looked at his watch 'Holy cats!" he yelled "An' me with my mail not made up!"

"Roarless Road" of Asphalt Spares Motorists' Nerves

ROARING of tires on asphalt roads is said to be eliminated by a new kind of surfacing being tried out in Massachusetts On a seven-mile stretch between Petersham and Barre, "pea stone" was used instead of the type of stone usually employed for surfacing Inspectors say that the new surface *is equal* to the old in quality and speed, while sparing motorists the nerve racking roar *usually* produced by tires on asphalt roads If the test *proves successful*, the new construction plan will be widely used in future road building, it is predicted.

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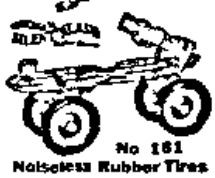


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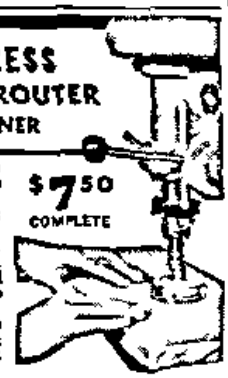
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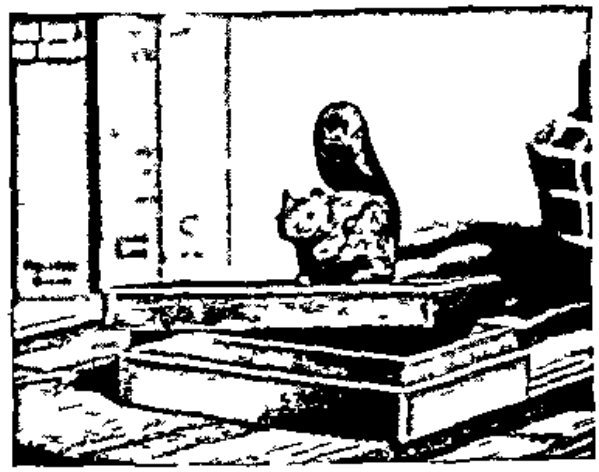
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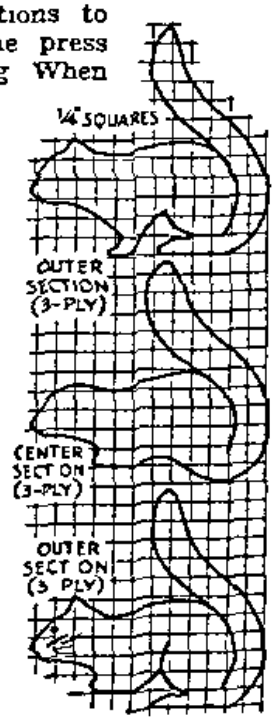
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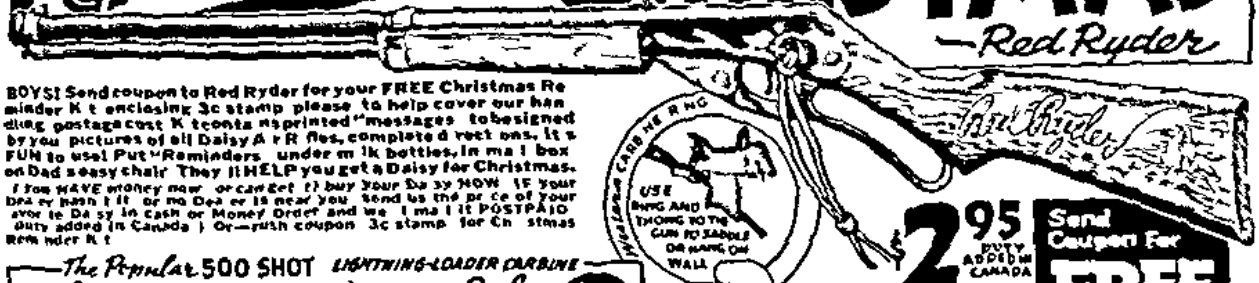
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Thread	⅜ 24	¼ -32	¼"-32
Thread Length	3/32	3/32	3/32
Weight, Grams	8	3½	2½

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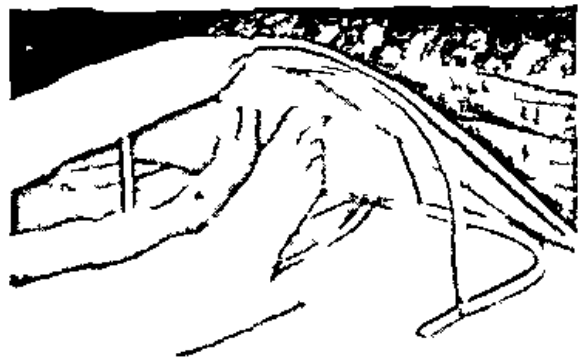
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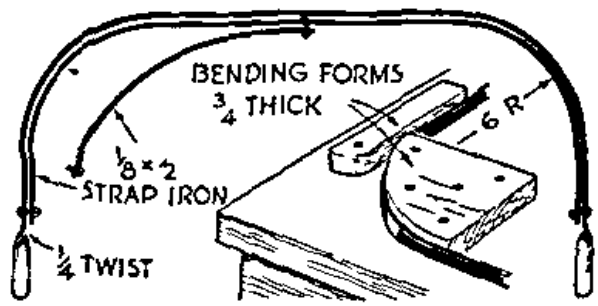


Metal Frame Lifts Bed Covers Off Invalid's Feet

ANYONE confined to bed for a long period can be made more comfortable by providing a frame to hold the bed covers up off the feet The materials required are three pieces of ⅛" by ½" strap iron one 43" long another 37" and the third 14" The joints are fastened with 8 32 machine screws

To enable the frame to be folded flat for storage one end of the curved center brace is held with a short screw that projects about 3/16" as shown When this projection is snapped into the hole at the center of the bottom piece the whole assembly becomes rigid.

The frame is finished with a coat of aluminum paint followed by two coats of white enamel—R. E MATHIAS



Three p eces of strap i on const tute the f ame Wood scraps na led to the bench a d the bend ng

Lacquer Marbleizes Wall Paper

FOR about three feet up from the floor the s de walls of our kitchen were somewhat uneven and rough. I put on a plastic effect wall paper and then brushed on linoleum lacquer which gives an attractive marbled appearance and protects the surface from water and grease When first applied the lacquer appeared to have ruined the paper but it dried beautifully Before trying this stunt, however it would be well to test the lacquer on a sample of the paper as papers vary a good deal.—R. J McCUTCHEON

POWERlite



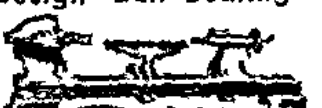
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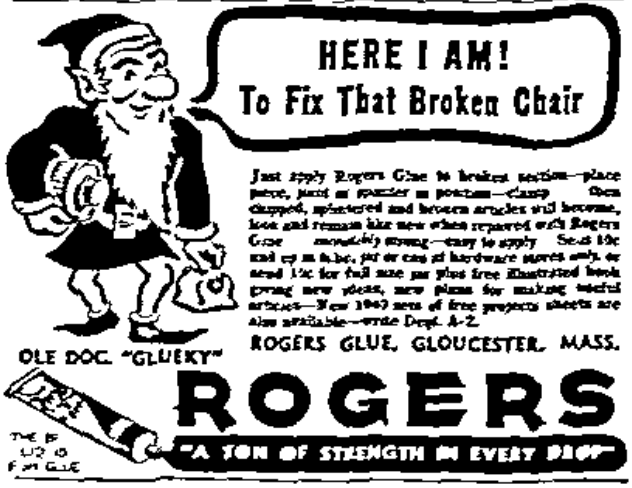


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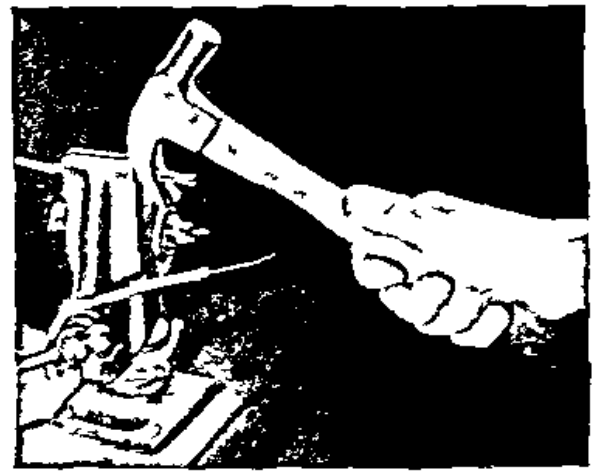
SEE PAGES 218-225





Insulation Stripped Off Wire with a Claw Hammer

AN ORDINARY claw hammer, used as shown with a combined pulling and twisting movement, makes an effective insulation remover The wire should be held firmly in a vise or looped around a nail or piece of securely anchored wood.



The hammer is pulled and twisted simultaneously

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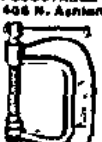
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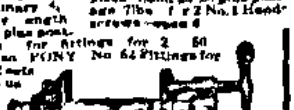
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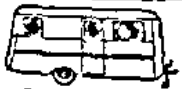
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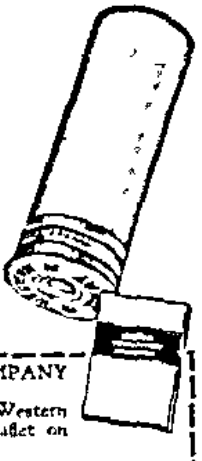
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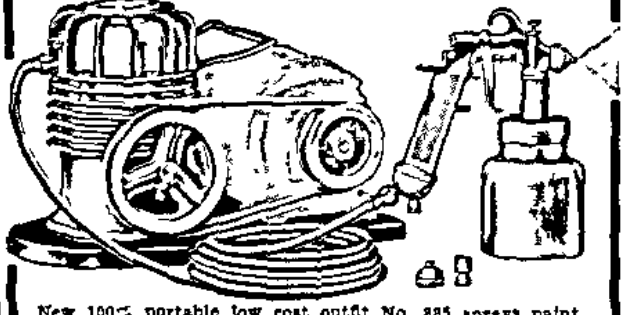
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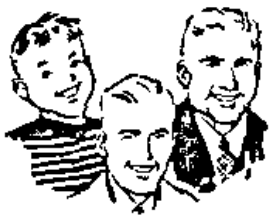
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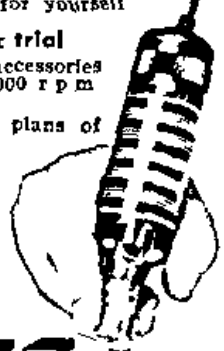
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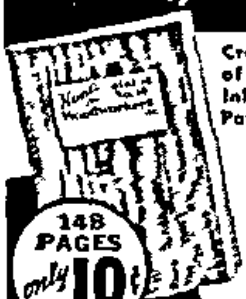
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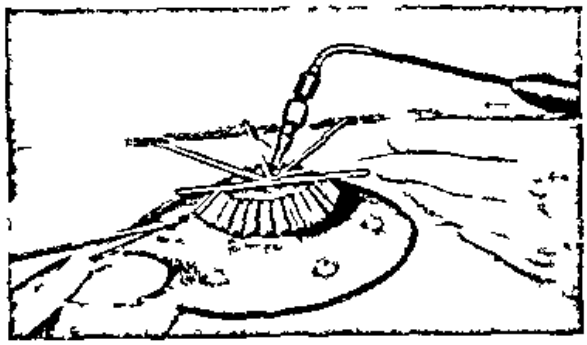
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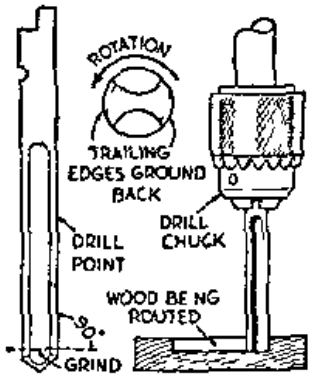
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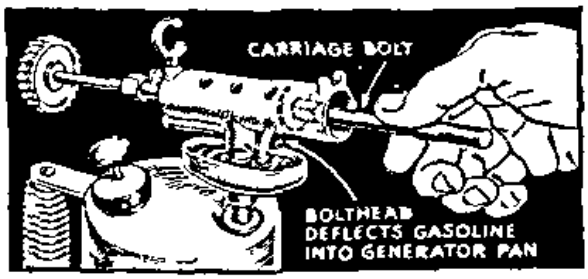
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Bolt Aids in Starting Torch

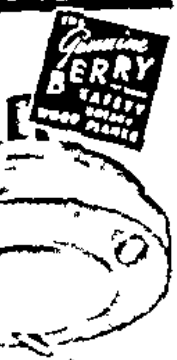
WHEN starting his blowtorch, one tinsmith inserts a large roundhead bolt into the burner cylinder as shown in order to deflect the stream of raw gasoline down into the generating pan until it is filled.



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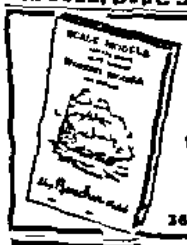
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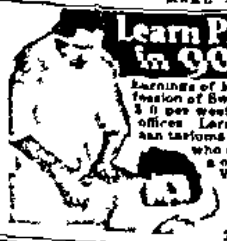
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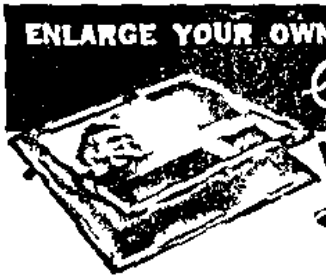
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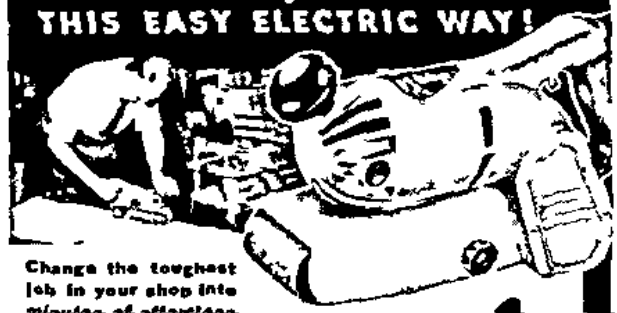
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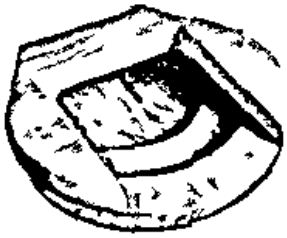


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ONLY three pieces of ¾" thick walnut stock are required to make this unusually beautiful modernistic cut-flower holder With your jig saw set at a 10 deg angle, cut two circular pieces to a diameter of 7", but leave an extension on one side of each, as shown, for the base Keep the saw table at the same angle and cut two smaller circles from these pieces as indicated The edges of these disks are sanded smoothly and pushed through to project as far as they will go They are then glued in this position



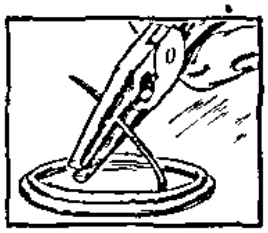
The center section or spacer is a circular piece, cut slightly larger than the two largest pieces of the front and back From this section cut a hole $4\frac{1}{4}$" wide and 5" deep, in which a copper water container





fits Sand all parts to smoothness then glue together Finish by staining filling and varnishing in the usual way Bend and solder a copper water holder to fit snugly into the recess as shown on the preceding page —B B BRONSON.

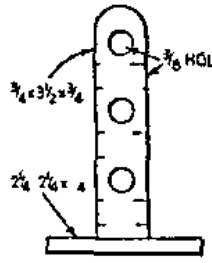
License-Badge Pin Knurled to Prevent Slipping

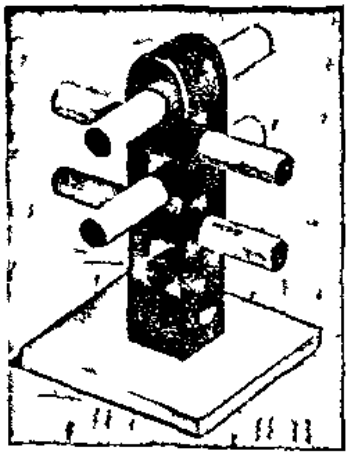


TO GUARD against losing a hunter s license badge knurl the pin with a pair of pliers This roughens the pin so that it stays in place even if unclasped

Table Cigarette Dispensers Made of Crystal Plastic

NOVEL cigarette dispensers, from which your guests may help themselves at the table may be readily made from any crystal like cast resin plastic The upright is a square rod of clear plastic of the desired color Shape it round at the top with a jig saw, and drill six ⅜" holes in rows of three at right angles to each other as shown After being polished the upright should be cemented to a base of ¼" thick white plastic This is another popular design prepared by the Metropolitan Junior Achievement New York —K. M S





Any crystal like plastic may be used The top is shaped round with a jig saw

Uses for Discarded Machine Beds

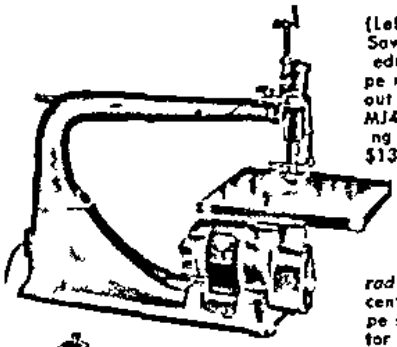
IN MOST machine shops it pays to save a few discarded machine beds for possible use in assembling the special shopmade equipment required from time to time in order to handle unusual jobs economically —H C

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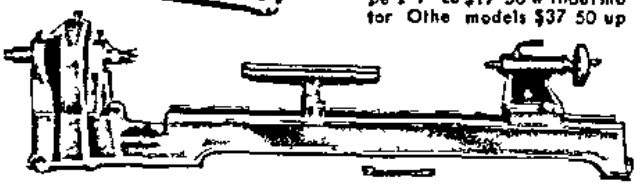
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(Left) 24" Direct Drive Jig Saw Patented blade tensioner reduces blade breakage and permits varying tension without stopping machine Model MJ44 shown $41 50 including motor Other models from $13 50

(Below) Walker Turner model L540 Gap Bed Lathe Ample overload capacity—both thrust and radial Head and tailstock centers have No 2 Morse Taper s Price $17 50 without motor Other models $37 50 up



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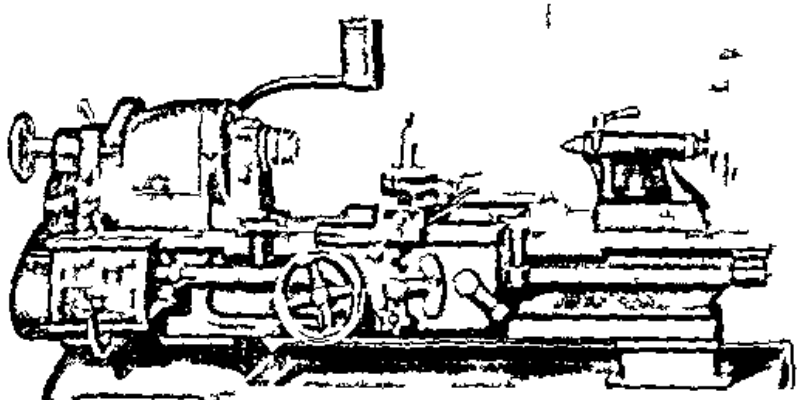
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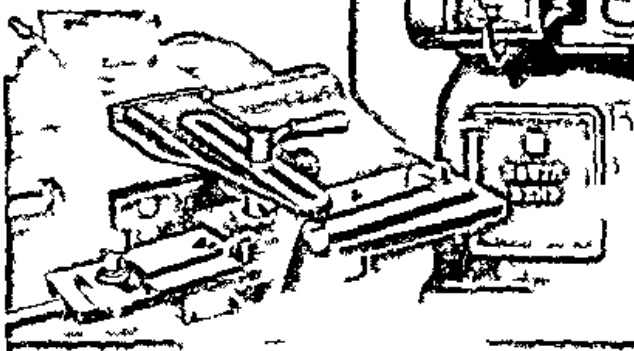
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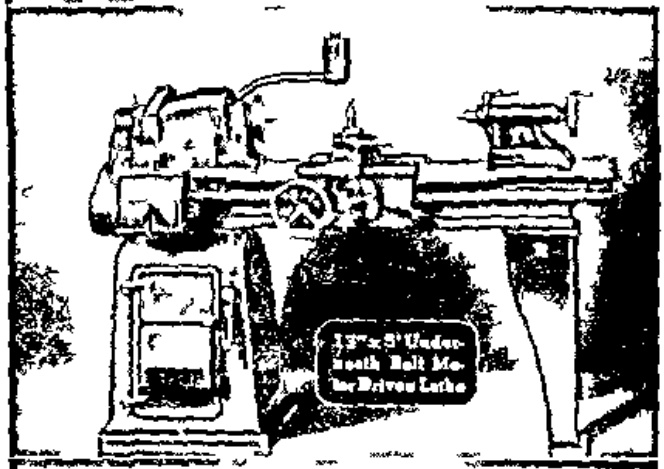
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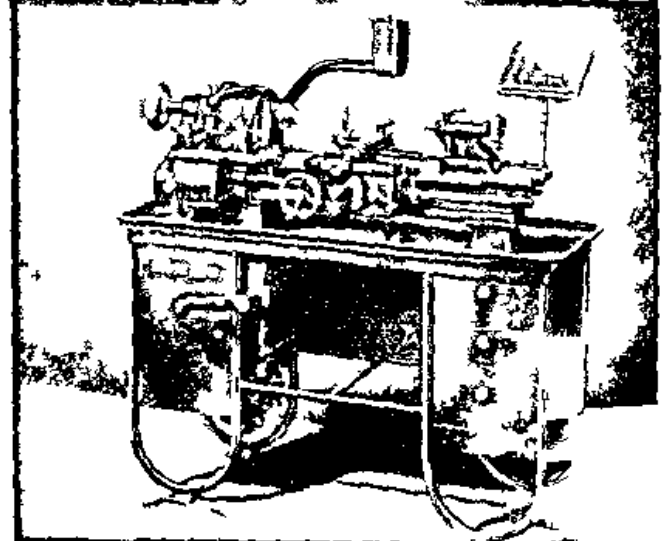
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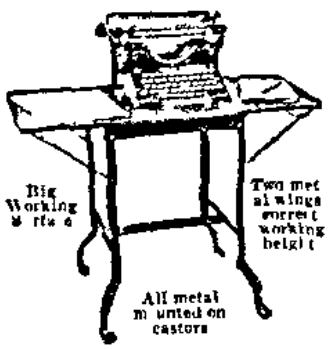
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